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SOCIAL AND ECONOMIC STUDIES OF POST-WAR FRANCE

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VOLUME III

THE ECONOMIC DEVELOPMENT OF POST-WAR FRANCE

A SURVEY OF PRODUCTION

BY

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AND

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THE ECONOMIC DEVELOPMENT OF POST-WAR FRANCE

A SURVEY OF PRODUCTION

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PREFACE

The economic history of France during the decade following the World War has been unusually interesting, attracting more attention at times than even the political and diplomatic events of the period. Of all the economic episodes, the most dramatic were undoubtedly the monetary disturbances. The depreciation of the franc was spectacular, particularly as seen in the day-by-day foreign exchange quotations and in the rise of prices. It carried the threat of national disaster and actually brought ruin to some classes and windfalls to others. These currency disorders which affected trade, industry, and the social, political, and cultural life of the country did not, however, constitute all nor indeed the most important economic phenomena of post-war France.

The phenomena of inflation and deflation have been essentially temporary, though some of their effects extend beyond the period of stabilization. The greater part of the lasting changes in French industry and agriculture are to be explained by something more fundamental than monetary fluctuations. The increase in natural resources, the modernizing of productive equipment, the development of power, the process of rationalization in industry, the adoption of new techniques and new inventions, and the growth of business organization, constitute underlying stimuli which have probably contributed most to the post-war economic evolution of France. There is striking evidence that the continuity of France's economic development, with its roots deep in the past, has been less affected by the war and inflation than is ordinarily supposed. This is revealed by a study of the data of physical production and other symptoms of industrial progress, which are more reliable indices of the material welfare of a people than a vacillating currency.

A

Part I of this survey describes broadly the post-war territorial expansion of France, her acquisition of new sources of economic

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power, her financial difficulties, credit conditions, and unstable supplies of monetary capital, with special reference to the effects of these phenomena on the output of French fields and factories. At the close of Part I the authors endeavor to appraise the new industrial status of France. Thus the first part of the book embodies the more general conclusions.

Part II consists of a series of monographic studies of French mines, key industries, agriculture, foreign trade, and combination tendencies. This last feature of the economic evolution of post-war France is especially significant because the more important French combinations and cartels overstep the economically irrational national frontiers and prepare the way for a future organization of trade and manufacture in harmony with the requirements of an international economy. In the Appendices, selected statistical data are given. Only such compilations are included as are original or relatively inaccessible. The careful reader and the student who would carry the study of the contemporary economic history of France beyond these beginnings will find the sources of data indicated in the footnotes and bibliography.

The authors would like to express in this foreword acknowledgments and gratitude to those who have aided in this study. To the Columbia University Council for Research in the Social Sciences they owe the opportunity for making this investigation into the economic life of a great people in so significant a period. The assistance from the Social Science Research Council in making available the services of Mr. Jaffé while a holder of one of their fellowships is also very much appreciated.

Many of the French business men and agriculturists were very kind in furnishing data and information and in permitting visits to establishments. French governmental officials were also generous in supplying records and statistics. Colleagues in the faculties of the French universities were helpful in many ways to investigators from another land. To all these, too numerous to name, the authors are especially indebted.

The work for this volume has been done with the aid of a small but very competent staff. Mlle. France Chalufour was chief of this staff throughout the whole study, and her skill and judgment were at all times and in many ways of the greatest value. Mrs. Grace Jaffé helped a great deal in the preparation of the manuscript and has also very kindly read the whole of the proofs. Miss Vera Mikol has assumed much of the work in connection with the editing for the printer.

To all these we wish to express our appreciation.

William F. Ogburn
William Jaffé

Chicago, Illinois
May 16, 1929

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PART I

CHAPTER I

THE TRANSITION

The war of 1914–1918 wrought many changes in the economic status of the countries of the world. Some nations lost territories, natural resources, colonies, while others gained. The rates of development of wealth, income, capital investment, production and trade were greatly accentuated in certain parts of the globe while in other parts there were definite losses and retardations.

The years immediately following the war were critical. The belligerent nations, both victorious and vanquished, were impoverished and even the neutrals found their economic life, their markets, their sources of supply, their currencies disturbed. Important readjustments had to be made.

How has France emerged from the war? How has her relative position in the world of competing nations been affected? How has she fared in the period of post-war adjustments? And what changes have taken place in her economic life?

These questions cannot be approached without reference to the economic status of France before the outbreak of hostilities in 1914. Despite the sweeping and relatively permanent changes which the war itself brought about in the material life of the French nation, despite the fundamentally new turn which the Treaty of Versailles gave to its industrial life, practically all the apparently new phenomena are deeply impregnated with tendencies reaching back not only to the eve of the war, but to epochs long before. The thread of historical continuity, which was certainly diverted from its pre-war direction and was tangled and twisted by the war and the territorial changes that followed, remained nevertheless unbroken. In fact, the post-war *bouleversements* have no intrinsic significance; their importance can be understood only when measured against the condition of affairs prior to 1914. Furthermore, a comparison between France of to-day and pre-war France rettitude.

veals how inexorable is the march of events, and how futile it is to contemplate a return to the "normal" *status quo ante bellum.*

I. PRE-WAR FRANCE

Before the war France had an area about the same as Germany. To-day France is the largest country in Europe, except Russia. It covers a territory approximately equal to that of the five states of Illinois, Indiana, Ohio, Kentucky and West Virginia, and is thus about one-fifteenth the size of the United States.

Physical Geography and Economic Resources of France

The mere area of a country, however, is not as significant as what that area contains. Most of the land in pre-war France was under cultivation. In this respect the war has made very little change. The climate of France is temperate, and her soil is adapted to a great variety of agricultural products ranging from cereals and vineyards to garden vegetables and fruits. There are no deserts in France. There are, to be sure, mountainous sections: the Alps in the southeast, the Pyrenees in the southwest, the Vosges in the east, the rocky plateau of Auvergne in the south central region, and a few mountains interrupting the forests and pasture lands of Brittany in the extreme west. Nearly half of her land is under cultivation. This is a somewhat higher proportion than is to be found in most of the other European countries. In the United States only one-fifth of the land is under cultivation.

In addition to being endowed with a richly fertile soil, pre-war France was fairly well provided with other resources, as, for example, coal, which is one of the primary requisites of present-day industrial life. In Europe there are not many large coal beds and those few are found in concentrated groups. The coal utilized in Western and Central Europe comes, in general, from three regions. The first and most important is in England. The second coal center is that section of Western Europe where Germany, Belgium and France meet, and here by far the largest portion of the coal beds lies in Germany. Less important are the deposits in the third region, in Silesia, at the intersection of the boundaries of Germany, Poland and Czechoslovakia. There are, in addition, other small deposits scattered here and there over Europe.

Before the war the coal reserves of France were estimated at about 18 billion metric tons, while those of Germany were estimated at 423 billion and England's at 190 billion. The Belgian deposits were estimated at 11 billion and Austria-Hungary's at 59 billion.[1] The deposits in the United States, on the other hand, were enormous beyond comparison: 3800 billion tons, much greater than all Europe's supply.

While the French deposits were therefore small compared with those of England and of Germany, the proximity of France to the coal beds belonging to her neighbors enabled her to develop industrially. France thus met about one-third of her coal needs from purchases close at hand. Her annual consumption of coal in 1909–1913 was 61 million tons, while that of Germany was 159 million, and of Great Britain 184 million.[2] Belgium consumed 25 million tons, Russia 34 million, Italy 10 million and Spain 7 million.

Coal is not the only source of power required for industrial development. In the process of replacing human and animal energy by other forms of motive force, oil has in recent times played a rôle of ever increasing importance. Before the war, however, France, like most countries of Europe, particularly Western Europe, had no oil. No petroleum resources had been found on French territory.

In hydro-electric power, on the other hand, France was very rich even in pre-war days. The slope of the streams in the Alps of the southeast of France, in the Pyrenees of the southwest and in the Massif Central of the south center made the French potential supply of hydro-electricity of equal rank with that of the most important water-power countries of Europe, such as Norway, Sweden, Switzerland and Italy. France was thus compensated, in part at least, for her inferior coal supply by possessing resources of hydraulic energy incomparably greater than those of England or Germany. Her developed water power on the eve of the war came to about a million horse power at average flow, which represented roughly a tenth of her total potential capacity.

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[1] *Bulletin du Comité des Forges*, No. 3372.

[2] This estimate includes lignite, coke and briquettes in terms of coal. Source: League of Nations, *Memorandum on Coal*, Vol. I, p. 12.

Steel was of no less importance to the pre-war industrial progress of France than the new sources of power, for the harnessing of the forces of nature to man's use depends on machines and tools that are almost all made of this derivative of iron. France was and continues to be exceptionally well endowed with iron. Iron ore is found quite widely among the different regions of the globe but it is usually scattered so much that it is not readily available for industrial uses.

The greatest single deposit of iron in Europe is found in Lorraine, where there are estimated to be over 4 billion tons of ore. Before the war, when part of Lorraine was German, only a little over half of these deposits were situated within French borders. Furthermore, the quality of the ore and proportion of the iron in the ore on the French side were not quite as high as in German Lorraine. This ore was in fact inferior in quality to the ores in other parts of France. In addition to the Lorraine deposits, France had other important iron resources scattered through Normandy, Maine, Anjou and Brittany. There were also small deposits of excellent ore in the Pyrenees and numerous other secondary beds. In all, according to the International Geological Congress of 1910, France possessed 3.3 billion tons of iron resources. Germany and England also had large deposits, while Belgium, Italy and Spain had very little iron ore. The average annual production, 1911–1913, was 19 million tons of ore in France, 15 million in Great Britain and 26.5 million in Germany. Italy produced about half a million tons. The United States produced 53 million tons.

The close proximity and the abundance of coal and iron in England, Germany, France and Belgium made this region the heart of the industrial life of Europe. France participated in this combination both by virtue of her own possessions and by her nearness to the supply of other nations.

Copper, which has an important though limited use in the development of industry, was largely imported by France, her production constituting less than one-tenth of her needs. She produced about one-half the zinc and lead required. Gold and silver have never been found in French soil, and France has always been an importer of these precious metals for her arts and for her money.

While France possessed power and steel, which were the two most essential factors for a certain measure of industrial progress, a good many elements were lacking wholly or in part for an elaborate economic development. For these she has had to resort to importation according to the requirements of the productive organization built up. Most notable among the imports were cotton, wool and silk. For all of these she was and still is heavily dependent upon other countries. The raw cotton has always been imported rather than cotton cloth and clothing. For many years before the war her production of silk cocoons had been diminishing, partly because of the nature of the labor-demands necessary for raising them. So also wool production in France has been steadily declining as the use of labor and land for sheep grazing was found less advantageous than for other purposes. During the years 1910 to 1913, the production of raw silk was only 9.2 per cent of the consumption, and the production of wool 13 per cent of the consumption. Another necessity of modern industrial life is rubber, a tropical product, which has always had to be imported. France was obliged to import also wood, wood-pulp, paper and hides for leather. As modern transportation became more and more dependent on the combustion engine, so the imports of oil increased. It was moreover necessary to import fertilizers for her agriculture: nitrates, phosphates and potash.

Besides the key industries there were a number of minor branches of manufacture which depended wholly on imports for their raw materials, but which contributed nevertheless to the economic prosperity of France. Such, for example, was, and still is, the jewelry industry. The precious stones employed were all imported, but they were cut, polished and mounted in France, and then sold in large quantities to other countries. Though many raw materials had to be imported by France, this was certainly not true of all. France had her own crops, her own dairy products, her own wines, her forests and her animals.

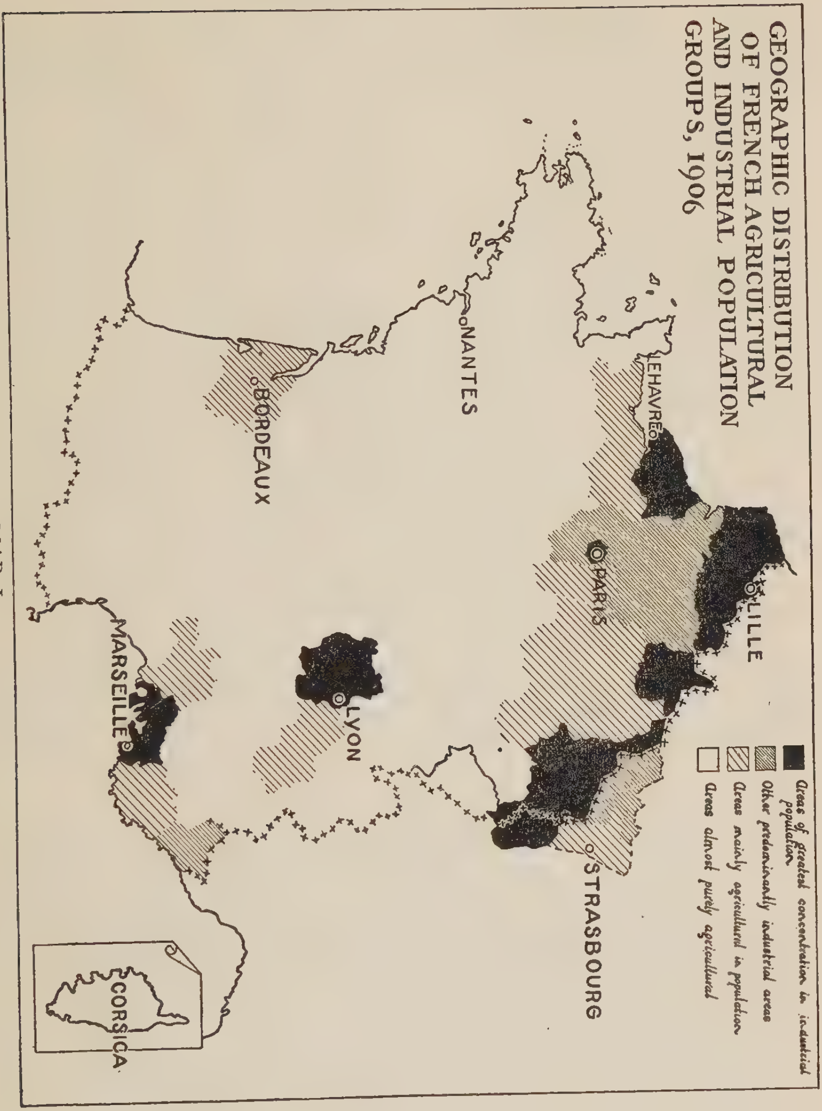
In her partial dependence on imports for raw materials France was not at all unique. England and to a lesser extent Germany both leaned heavily on the outside world. Other countries of Europe like Spain and Italy imported not only raw materials for the machines, but the machines themselves and the power as well, in order to manufacture.

The agricultural yield of France was almost sufficient to satisfy all domestic requirements in 1913. It was necessary at that time to import less than 10 per cent of the cereals, less than 1 per cent of the meat, and about 16 per cent of the wine consumed. France was of course dependent upon other countries for coffee, tea, and tobacco. A small percentage of potatoes and sugar was even exported. France was rather more fortunate than the other industrial nations of Europe in having within her boundaries a larger food supply for her citizens. Germany's per capita imports of wheat before the war were 20 per cent greater than those of France, while Great Britain's were nearly 5 times as large and Belgium's nearly 8 times. Even Italy, with a much larger agricultural than industrial population, imported 70 per cent per capita more than France.

The Economic Distribution of the French Population

The relatively high degree of agricultural self-sufficiency was due mainly to the fact that the urban development of France and her increase in industrial population were not out of proportion with the extent of her fertile lands. In 1911, only 44 per cent of the population lived in cities, that is, in places of over 2,000 inhabitants, while 56 per cent lived in the rural districts. Not all of the latter were engaged in farming, though in very small places some production of food was carried on by most of the families. The fairly even division of the population between fields and factories is shown yet more clearly by the fact that 41 per cent of all gainfully occupied persons in 1911 were engaged in agriculture, the others being occupied largely in industry and commerce and miscellaneous non-agricultural pursuits.

Geographically the distribution of the industrial and agricultural population groups over the surface of France was anything but


GEOGRAPHIC DISTRIBUTION OF FRENCH AGRICULTURAL AND INDUSTRIAL POPULATION GROUPS, 1906
■ Areas of greatest concentration in industrial population
▨ Other predominantly industrial areas
▨ Areas mainly agricultural in population
☐ Areas almost purely agricultural
LILLE
LE HAVRE
PARIS
NANTES
BORDEAUX
STRASBOURG
LYON
MARSEILLE
CORSICA

MAP I

uniform. As the accompanying map indicates,[3] the great bulk of factory workers were huddled along the northern and northeastern frontiers of France, in and about Paris, in the Lyons region and in a few other scattered districts. The rest of France, that is, by far the greater part, was mainly agricultural in its population and in its productive activity. The whole of the west and nearly all of the south was practically devoid of any important industrial agglomerations.

Despite the fact that industry in its advanced and concentrated form was found in only a small portion of France, manufacturing activity held a very significant place in the economic life of the country. In 1911 36.5 per cent of the gainfully occupied population were engaged in industrial pursuits and transportation. At the same epoch, the industrial concentration of England, Wales and Scotland was considerably more accentuated with 54 per cent of their active population engaged in industry and transportation. In Belgium the percentage was 54 and in Germany 43.8; in Italy, on the other hand, the percentage was only 29.9.

The relative importance of particular types of industries before the war is seen in the proportion of the active population employed in each. The French Census of 1906 gives the following data: clothing 21.5 per cent, textiles 12.7 per cent, metals and metallurgy 11.5 per cent, wood 9.8 per cent, transportation 6.8 per cent, construction 7.6 per cent, foodstuffs 6.6 per cent, handling (*manutention*) 5.5 per cent, leather and hides 4.6 per cent, mines 2.9 per cent.

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[3] The shading of Maps I and II is based on the French census reports by départements in 1906 and 1921 (as published in *Résultats statistiques du Recensement général de la Population effectué le 6 Mars 1921*, Vols. II and III), and is designed to show the distribution of the gainfully occupied population between field and factory. For each département the number of persons engaged in categories (1) Fishing, (2) Forests and Agriculture, (3) Extractive Industries, (4) Transformation Industries and (5) Transport and Shipping, were added together to form a total of those engaged in physically productive pursuits as distinct from persons in commercial and liberal professions, etc. The ratio of categories (3), (4) and (5) to this total gave the percentage engaged in industrial pursuits, the remainder being regarded as engaged in agricultural pursuits. Those départements in which the industrial population represented 60 per cent or more of the total described above were designated as "areas of greatest concentration in industrial population." The départements in which the industrial population formed between 50 and 59 per cent were called "other predominantly industrial areas." The lightly shaded regions were made up of départements in which the agricultural population constituted between 50 and 59 per cent of the total; and the unshaded areas include those départements where the agricultural population represented 60 per cent or more of the total.

French Trade, Industry and Wealth

Pre-war France was thus in a sort of intermediate position: possessed of a good domestic supply of coal and iron and food, she was at the same time obliged to import great quantities of raw materials. About 60 per cent of her total imports in 1913 consisted of industrial materials[4] destined to be worked up by her labor and machinery, and then sold either to her own people or to others. The 39 million people of France in 1913 constituted an immense home market. The absorbing capacity of these people was further increased by their relative compactness, for the population of France, while not quite as crowded as that of England, Germany, Belgium or Italy, was six times as dense as that of the United States.

Not all the domestic demand for finished products was supplied by home industries; nearly one-fifth by weight of the total French imports before the war consisted of manufactured goods. Their value was about one-third that of the raw materials imported. Neither this fact, nor the per capita value of the imported manufactured goods, can be regarded as indicative of the development or lack of development of manufacturing in France. What was true of France in this respect was equally true of all other industrialized countries. Considered as productive organisms they were all of them specialized and far from industrially comprehensive within any set of national frontiers. The importation of finished products was therefore a universal necessity. Furthermore, the volume of manufactured imports has always been a function of the wealth of a country, as well as of the tariff policy. The per capita value of imports of manufactured goods into France in 1913 was about 60 per cent greater than that of Germany, twice that of the United States, 75 per cent more than Italy, but only

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[4] These industrial materials are designated in the French foreign trade statistics as "matières nécessaires à l'industrie." They comprise with very few exceptions what are generally called "raw materials" in the United States.

58 per cent of the per capita value of manufactured imports into Great Britain.

The ability of France to purchase abroad large quantities of raw materials and then to sell part of her manufactures in foreign markets was due to her relatively abundant supply of skilled and, in some cases, of cheap labor. Indeed the prevalence of a high degree of skill was largely a consequence of the late development of steam industry in France, which had its counterpart in the prolonged continuation of handicraft trades while they were elsewhere being replaced by machine production. Thus, thanks to the long training of her silk workers, France was able to buy raw silk from the Orient and from Italy and then to sell most of her manufactured silk goods to peoples of other countries.

France was not so dependent on the cheapness of her labor as was Italy, for Italy had to import both coal and iron in addition to raw materials. The wage in France in 1913 for an underground coal miner was 6 francs per day, the franc being worth at the time 19.3 cents. Unskilled workers in the building trades in other towns than Paris were paid 3.26 francs a day. French labor judged from these indices was of course much cheaper than labor in the United States before the war. It is very difficult to make precise comparisons of wages in different European countries, but probably the workers in Great Britain and in Germany were paid somewhat more than in France, while in Italy they received less. In general, British common labor in the building trades in 1913 received the English equivalent of 5.68 francs, while in Germany it received the equivalent of 5.98 francs. In Rome, common labor received about 3.5 francs a day, and in the rest of Italy probably a good deal less.[5]

As regards the volume of manufactured exports, which undoubtedly reflects the status of industrial development, France stood before the war in the following comparative situation with respect to her neighbors. Her manufactured goods exported in

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[5] These figures were computed from the pamphlet of the International Labor Office, *Wage Changes in Various Countries, 1914–1925*. The wage rates for all countries except France were determined by dividing the weekly wage rates by 6. The comparison can give at best only a rough indication.

1913 were evaluated at 4.2 billion francs, while those of Germany were worth 8.3 billion francs, Great Britain's 9 billion, and Italy's only 0.7 billion. The principal articles of export from France were textile products of various kinds, machines, tools, steel products, automobiles, certain chemical products, paper, rubber, leather goods and wines. Furthermore, France exported a certain amount of raw materials representing in 1913 27 per cent of her exports, while manufactured goods represented 61 per cent. All of these were sold chiefly to her closer neighbors, England, Germany and Belgium, and also to other countries scattered over the trade routes of the world. Her colonies took about 10 per cent of the sales.

The economic position of France before the war was in no sense stationary. In fact her general development had been increasingly rapid in the years immediately preceding the war. Her foreign trade grew by about two-thirds, from 1903 to 1913. In the previous decade it had risen less than a third. In this respect the progress of France was not as great as that of Germany, where the rates of increase in the volume of foreign commerce for the two decades were respectively 88 per cent and 56 per cent, but it was greater than England's 55 per cent and 30 per cent for the same two decades. Another and perhaps more significant indication of the speed of French industrial advance is to be found in the statistics of coal consumption. The increase from decade to decade was about 33 per cent in France. In Germany it was much greater, but in England the rate of increase was slower.

The general economic prosperity of France and the thriftiness of her people on the eve of the war were such as to leave large surpluses of capital for foreign investments. About 45 billion francs were invested abroad principally in government bonds of Eastern and Central European countries.[6] This colossal edifice of foreign investment had been built up despite the fact that France purchased abroad annually more merchandise than she sold.

The national income of France from all sources amounted in

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[6] *Cf.* Vol. I of this series, Robert M. Haig, *The Public Finances of Post-War France* (New York, Columbia University Press, 1929), and Moulton and Lewis, *The French Debt Problem* (London, 1925), p. 20. This outlet was preferred to that of foreign industries, mines and business enterprises.

1913 to probably 37 or 38 billion francs, according to the estimate which M. Théry made at the time. Other appraisals dating from the same period were slightly lower, but these are now generally regarded as having been undervalued. The estimate used by the French financial delegates at the Reparations Commission was 35.9 billion for 1913. If the figure 37.5 billion is taken as the basis for calculation, the annual per capita income amounted to about 950 francs. In the United States the per capita income was nearly twice (1.82 times) as large, when measured in terms of the same monetary unit, and in Great Britain it was one-third larger.[7] The total income of the German people was considerably greater than that of the French, but their per capita income, perhaps contrary to general opinion, was smaller by about a fifth. In Belgium the per capita income was roughly nine-tenths as large as that in France, and in Italy it was only three-fifths as large. These comparisons are all made in terms of a common currency and thus give a consistent pre-war ranking. In view of the fact, however, that from country to country there were more or less significant disparities both as to costs of living and as to the distribution of income among the different economic classes, the above data should probably not be taken as an absolute measure of the relative richness or poverty of the various peoples considered.

The intense exploitation of the natural resources of France, the immense volume of imports of raw materials and of exports of manufactured goods, the imposing aggregate of investments abroad and the size of the French national income, all give the impression of great progress in French industry before the war. Still there are reasons to believe that the process of industrialization was not as advanced in France as in other countries. The reputation of France for her "de luxe" industries, her fame for jewelry, art objects and fashionable feminine apparel point, in fact, to a prevalence of handicraft industries. The little shops where these articles were fabricated, and the comparatively small plants so frequently found in the engineering and textile industries and on the farms were vestiges of a type of production that had been dominant in the world of industry several generations earlier, at a time when the industrial revolution was still in its infancy. How far France lingered behind the United States with respect to the size of industrial plants is seen in the fact that those manufacturing establishments which employed from 1 to 5 wage earners constituted in France (in 1906) 87.6 per cent of the total number of manufacturing establishments and in the United States (in 1905) 38.8 per cent.[8] This means that diminutive shops were before the war more than twice as frequent in France as in the United States. The small factories with six to fifty employees, which represented nearly half (47.8 per cent) the total number in the United States, were only 10.9 per cent of the total in France. As for the really large-sized plants employing more than five hundred wage earners, these were indeed very rare in France. They constituted less than one-tenth of one per cent (.09 per cent) of the total, while in the United States they were proportionally ten times as frequent (.9 per cent). These figures reveal very vividly how little mass production had been developed in France at that time.

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[7] The estimates of the total national income in 1913 for the United States and for the other nations cited are as follows: for the United States (National Bureau of Economic Research), 33.2 billion dollars; for Great Britain (Sir Josiah Stamp), 2.25 billion pounds; for France (estimated from M. Théry's wealth estimate), 37.5 billion francs; for Belgium (approximated from several different authorities), 6.5 billion francs; for Italy (estimated by Corrado Gini), 20 billion lire; for Germany, 43 billion marks.

The general backwardness which characterized the technique of French production before the war is even more strikingly brought out by the fact that in the utilization of steam power France was not nearly as advanced as the other industrial nations of the world. The quantity of steam-generated horse power offers an excellent criterion for measuring the relative status of industrial development for the pre-war period, because at that time both hydroelectric plants and combustion engines were still in their infancy and the steam engine was unrivalled as the principal source of productive energy. In 1913 the steam power generated in France amounted to 3.5 million horse power. Germany produced nearly twice as much, with 6.7 million horse power (in 1907); Great Britain about three times as much, with 9.8 million horse power (in 1907); and the United States almost seven and a half times as much, with 26.1 million horse power. These striking differences are, of course, partly attributable to the fact that the countries compared with France had larger populations and consequently a larger underlying industrial structure. But even when considered on a per capita basis, France's showing before the war was a poor one. If the per capita pre-war production of steam power in France is taken as 100, the index for Germany at the same epoch is 123, for Great Britain 244, and for the United States 311. And that too, although France, thanks to her propinquity to England and thanks also to the mechanical genius of her people, was one of the first nations of the world to participate in the industrial revolution which has been constantly changing the technique and the organization of production since the middle of the eighteenth century. Indeed the industrial progress of France had been relatively slow from about 1850 up to the war.

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[8] *Résultats statistiques du Recensement général de la Population, 1906*, Tome I, deuxième partie, p. 182; *United States Census of Manufactures, 1905*, Part I, Table LXVIII, p. cxviii. The French data on which these percentages were calculated were the number of establishments in the transformation industries (category 4) and in the state industries (category 9). These are very approximately comparable with the 14 groups of industries in the United States Census. Establishments with no employees at all were left completely out of account.

French Colonies

The picture of pre-war France is not complete without some consideration of her colonies. The past few centuries have seen great changes in the nature and geographical distribution of the French possessions beyond the seas. In the seventeenth century France constructed a vast colonial domain in America, but it passed out of her hands in the eighteenth century. These losses were eventually compensated by the acquisition of extensive territories in Africa and in Asia during the nineteenth century. On the eve of the war France was second only to Great Britain in the size of her colonies and protectorates. This only meant, however, that her possessions were in area a third of Great Britain's, in population not even one-eighth, and in wealth and natural riches very inferior indeed. It must be remembered that the British Empire covered about a quarter of the globe and comprised a fourth of the world's population. On the other hand, pre-war France possessed at that time four times as large a colonial domain as

Germany. The French colonies and protectorates were vastly superior to those of Italy, whose colonial empire, situated principally in Northern and Eastern Africa, was even smaller than Germany's.

Colonial strength, however, is not to be measured by area and population alone. The economic significance of colonial possessions turns on their value as sources of food products, coal, oil and other raw materials for the industries of the mother country, on their suitability as places of investment for her surplus capital, and on their capacity as markets for her manufactures.

The French colonies were endowed with no mineral resources of particular note except the very extensive natural phosphate mines of Tunisia and Algeria. They possessed also considerable quantities of iron, lead and zinc. The only French overseas possession containing coal was far-off Indo-China which, before the war, produced about half a million tons per year. Oil was not known to exist in significant quantities anywhere among the French colonies. Minor metals like mercury, cobalt, graphite, tin, manganese, nickel and even some copper, gold and silver were found scattered here and there among the French possessions.

These colonies were not, on the whole, a rich source of industrial raw materials other than mineral products. Very little cotton, for example, had been grown in them. The only possession sending wool in considerable quantities was Algeria. As was to be expected, the immense expanse of French territory in Central Africa furnished important quantities of distinctly tropical products such as rubber, skins and special woods.

The principal value of the French colonies lay in their agricultural products, which consisted primarily of foodstuffs. The mother country imported from her tropical and semi-tropical possessions such products as tea, coffee, vegetable oils, fruits, peanuts, copra, cocoa, sugar, rum and rice. North Africa may be regarded, in fact, as a sort of agricultural continuation of France itself, for besides supplying considerable quantities of raw wool, it helped to cover the mother country's deficit in cereal production, and furnished also meat, wine and fresh fruits.

Outside of Indo-China and Algeria there was before the war practically no industrial development in the French colonies. The opportunities for profitable investment for French or foreign capital were, therefore, very limited. Furthermore, since colonial, like foreign commerce ultimately depends upon a more or less equal exchange of goods and services, the possibilities of a wide expansion in the volume of trade had to await a further extension of industrial enterprise. The colonies were, nevertheless, able to absorb about 13 per cent of the total exports of France before the war. The goods they bought from their mother country represented in 1913 about 55 per cent (in value) of all their imports, the remainder having come from countries other than France.[9] With a better adjustment of her production to the needs of her colonies France might have captured a larger portion of their import trade.

It was, indeed, not their past accomplishments, but their promise for the future which determined the importance of these colonies to France. There were locked up in this far-flung empire untold riches and immeasurable latent possibilities for economic development. As sources of raw materials, and as places for the profitable investment of capital, their exploitation before the war had only just begun. This was clear from the remarkable achievements of North Africa which was in the van of the economic progress of the French colonies. These possessions just across the Mediterranean enjoyed, to be sure, a privileged position. They were so close to France that their trade could be directed toward the mother country to the exclusion of other powers without particular detriment to their development. Their native inhabitants were moreover sufficiently advanced in occidental civilization to offer a good market for French manufactured products. Investments of capital in these near-by colonies could be readily supervised. Aided by a favorable climate, their agricultural yield showed signs of rapid increase as scientific methods replaced the ancient routine of the indigenous peasants. These North African colonies were thus actually and potentially a great source of food supply for France.

Much less developed and separated from France by a far greater expanse of sea was Indo-China, but her huge population, even though still living at a rather primitive level of material existence, inspired vast hopes of future riches. No more than the surface of the enormous potentialities of the tropical colonies had been scratched. They were lands of bright horizons.

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[9] Albert Sarraut, *La Mise en valeur des Colonies françaises* (Paris, 1923), pp. 144–145.

Such was economic France on the eve of the great war.

2. France on the Reëstablishment of Peace

At the end of the World War the aspect of France described in the previous pages was profoundly modified. The years from 1914 to 1918 were intensely destructive, and their disastrous consequences permeated every phase of national life. The spiritual, moral and psychological changes were undoubtedly very great — but these are not measurable phenomena. In fact, the effects of the war, considered as a whole, are incalculable. Many volumes have already been written, bearing on one aspect or another of the subject,[10] but these could touch upon only a limited number of the post-war transformations. Nor can this chapter attempt to do more than to give a brief account of some of the especially important economic and industrial characteristics of France on the morrow of the war.

What France Lost by the War

The outstanding material results of the war, in so far as France was concerned, may be summarized as follows: the devastation of land, the destruction of buildings and equipment in the regions of the north which were occupied by the enemy; the loss in population; and the enormous growth in indebtedness which was accompanied by the forfeit of most of the French investments abroad. These ravages inevitably entailed other disastrous consequences such as currency disturbances, industrial stagnation and disorganized markets.

That part of France which came most directly under the heel of the war either because it was the scene of havoc-making hostilities, or because it was occupied by the enemy, comprised more or less completely ten départements of the north[11] representing 11.7

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[10] See particularly the volumes on France in the series, *Economic and Social History of the World War*, edited by James T. Shotwell, published in French by Les Presses Universitaires, Paris, and in English translation by the Yale University Press.

[11] France is divided from the administrative point of view into 90 départements.

per cent of the total area of the country. More refined estimates have whittled down the proportion of French territory actually devastated or occupied to only 6 per cent.[12]

This relatively small portion of France contained, however, the greater part of the French coal mines, and was the most highly developed industrial region of France, particularly noted for the manufacture of steel and textiles. In this territory were to be found also some of the best wheat and sugar-beet lands of France. In the 8.2 billion acres of invaded and war-ravaged territory, all but 15 per cent of the soil cultivated before the war was devastated and 94 per cent of the cattle had disappeared.[13] The magnitude of the destructive forces which literally shattered this region is further seen in the fact that at least three-quarters (900,000) of its dwellings, farm buildings and public edifices were damaged or destroyed. About 9,000 factories of the category employing 10 persons or more were either crippled or completely razed. The 200 coal-mine shafts and the 34 iron mines of this region were all wrecked. Half of the roads were torn up; 6,000 bridges and 1,500 miles of railway lines were demolished; 700 miles of canal routes were damaged.

The official statistics, while presenting the number of units of structures, roads, etc., affected, do not indicate the extent to which each was impaired. The figures are, therefore, difficult to interpret, and cannot be taken as a precise measure of the damage done. There is no question, of course, but that the destruction in this highly industrialized region must have been enormous. There was little or nothing, however, on the material side, that could not be restored; and this restoration was pushed forward at a remarkable pace and was well-nigh completed in a little more than half a decade after the cessation of hostilities. How costly the accomplishment of such miracles can be, will be seen later.

The most tragic loss of all was that of population. The 1911 census, the last taken before the war, enumerated 39.2 million inhabitants in France; and ten years later, in the same pre-war area, there were only 37.1 million inhabitants. More than two million persons had disappeared. Industry was thus bereft of a very appreciable part of its man power. This was a particularly grave loss for France whose population had for many decades been almost stationary. The French could not look forward to filling rapidly the awful gaps in the labor force, as might other nations which had a high birth rate.

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[12] Arthur Fontaine, *L'Industrie française pendant la Guerre*, p. 10.

[13] These data were taken from the summaries of official reports made by J. R. Cahill in his *Reports on the Economic and Industrial Conditions in France, 1922 to 1925* (Department of Overseas Trade, Great Britain. London, 1923–1927).

The fact is that the decline in man power from 1911 to 1921 was much more serious than the mere diminution in population indicates. While the decrease in the total number of inhabitants amounted to only 5.4 per cent, the drop in the number of males between 15 and 50 years of age in the same territory was proportionally more than twice as great (11 per cent). It was this category of the population which made up the very backbone of industry. As was to have been expected, since the destruction of life affected men almost exclusively, the excess of females over males between the ages of 15 and 50 rose from 2 per cent in 1911 to 15 per cent in 1921. The whole of the economic life of France was very much weakened by this loss of men, especially as regards agriculture. One of the most striking features of the post-war history of France is the tremendous effort made to compensate for this loss by the importation of foreign labor and by the intensified use of machinery.

The ravages of the war grievously undermined the productivity of field and factory. The French agricultural crop in 1919, the first year after the war, was only 70 per cent of the pre-war crop. The industrial and mineral output shrank even more, to 60 per cent of its pre-war volume.[14] This terribly depressed state of general economic activity did not last many years, but so far as agriculture was concerned the decline appeared to be permanent. From 1923 on, the area under cultivation, which had been steadily increasing up to that time, began actually to diminish.

A mere comparison of the index number of production of 1913 with that of 1919 gives a most inadequate idea of the degree of economic retardation caused by the war. Before 1914 the volume of industrial production, it has been noted, was by no means stationary. Indeed factory output had been increasing very notably in the decade prior to the outbreak of hostilities. There is no reason to believe that this movement would have stopped or even have slackened its pace, had it not been for the war.

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[14] Both pre-war and post-war figures refer to France including Alsace-Lorraine. See below, pp. 93–97.

If there had been peace, and if the rate of expansion in production had been the same from 1913 to 1919 as it was in a period of equal length before 1913, the 1919 output would have been 30 per cent greater than that of 1913 rather than 40 per cent less as it actually was. The war had really cut manufacturing activity in half. This was not true of agriculture, because the conditions determining its growth were very different. All that can be safely assumed is that, in the absence of war, there would have been no diminution in the average annual crop.

The balance sheet of the war reveals on the debit side not only a stupendous loss in human lives and a serious impairment of the productive forces of the nation, but also a sharp decrease in savings and in foreign and domestic investments. As has already been seen, the French people held at the outbreak of hostilities about 45 billion francs' worth of foreign securities, from which 7 billion, representing investments made by outsiders in France, must be deducted in order to arrive at the net amount of French foreign investments. The war caused a vast shifting of funds, and as a result France in 1919 was no longer a creditor nation. She found herself burdened, in fact, with a net indebtedness of 6.8 billion francs of pre-war purchasing power.[15]

The war plunged the French State very deeply into debt. During the four years from 1914 to 1918, the Government's net borrowings attained the figure of 128 billion francs, of which 30.8 billion were procured from foreign countries.[16] With the end of the war, neither the internal nor the external public indebtedness ceased to expand. The financial operations after 1919 led to an alarming and relentless increase of the public debt both at home and abroad.

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[15] *Cf.* R. M. Haig, *op. cit.;* Moulton and Lewis, *The French Debt Problem*, pp. 18 and 42; also P. Meynial, "La Balance des Comptes," *Revue d'Économie Politique*, Mars-Avril 1927, p. 288.

[16] Computed from the *Rapport du Comité des Experts* (décret du 31 mai 1926), pp. 148–149.

The foreign trade of France also suffered grievously from the war. The exportation of French goods in 1919 to foreign countries and to the colonies had shrunk in weight to only a quarter of what it had been in 1913. The factors affecting trade conditions are very numerous and extremely complex, but it is not difficult to see that, what with the complete disorganization of the whole European transportation system, what with the deterioration of most of the currencies of the world, and what with the impoverishment of buyers everywhere, it must have been extremely difficult for French exporters to find markets for their wares.

The most spectacular consequence of the war was its corrosive effect on currency. By 1919 the franc had lost 72 per cent of its pre-war purchasing power. In that year, so rife with post-war illusions, the franc might still be regarded as having been "pegged" psychologically, for it was destined to undergo still further depreciation as time went on. This destruction of currency value led to very grave economic disorders. It caused a sudden contraction in property values. It brought about unjust and arbitrary transfers of wealth. Certain social and economic classes of the French population were driven to the brink of destitution while others became rapidly enriched.[17] Moreover it was almost impossible to carry on any kind of industrial or commercial accounting or to transact any normal business with a constantly fluctuating monetary unit.

Improvements in the Economic Position after the War

That France lost by the war, was in part literally devastated by it, and came out of it almost bankrupt is so evident that it need not be insisted upon. These misfortunes did not prevent her, however, from becoming enriched in many respects at the same time. By the terms of the Treaty of Versailles, Alsace-Lorraine was reannexed, and the recovered provinces brought with them iron, coal, potash and oil resources of incalculable value.

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[17] *Cf.* Vol. VIII of this series.

Furthermore they contained a highly advanced and varied industrial equipment, which was especially noted for its blast furnaces, steel plants and textile mills. France's territorial gains were not confined to contiguous regions, for her empire beyond the seas was also enlarged. In Africa, some of the former German colonies which had at one time been French were reannexed, others were ceded to France as mandates. The acquisition of mandatory powers over Syria was also of economic importance.

Even within the pre-war boundaries of France there were certain definite ameliorations in the economic and industrial situation. When the enemy seized and occupied the great industrial area of the north, France was obliged to stimulate as far as possible the productive forces of other parts of her territory. If the map on the following page,[18] showing the distribution of the industrial and agricultural population groups in France in 1921, be compared with a similar map for 1906 (page 9) it is seen that the most notable intensification of industrial activity took place in the larger region which surrounds Paris, and extends from the English Channel to Alsace-Lorraine. There were also important relative increases in the industrial population in Lyons and its surrounding territory, in Belfort, along the Franco-Swiss frontier, and in Nantes and its environs.

Everywhere outside of the war zone the French endeavored to enlarge and improve the equipment of their coal mines, iron mines, blast furnaces, steel plants, textile mills, hydro-electric power sites, and chemical factories. The great effort demanded in wartime in the name of national defence inspired French industry with new vigor and aggressiveness. The spirit of invention was spurred, better methods of production were adopted and industrial growth was generally stimulated.

A series of fundamental changes had thus come over France between 1913 and 1919. As a result of the war, she was at once impoverished and enriched. In population, in agricultural and industrial production, in trade and in financial resources France found herself in 1919 decidedly a loser. On the other hand, in territory, in colonial domain, in basic natural resources and in

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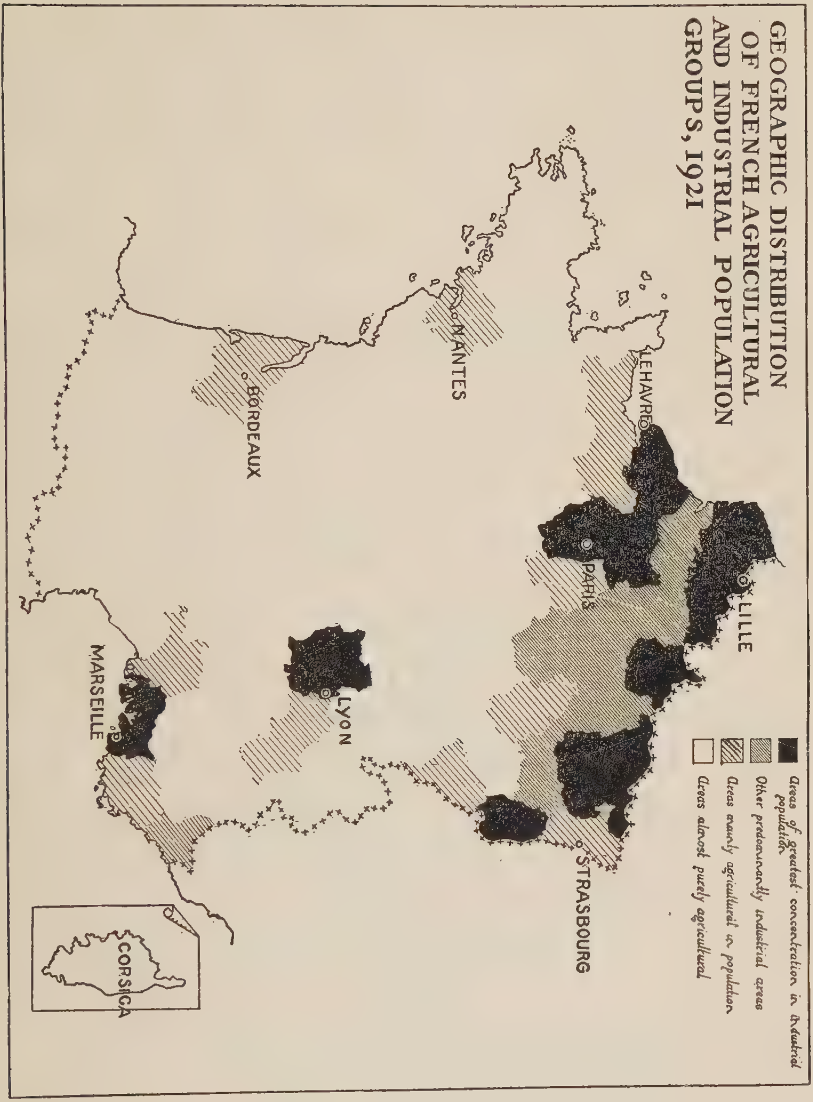
[18] *Cf.* note 3, p. 10, for data on which Map II was drawn.



GEOGRAPHIC DISTRIBUTION OF FRENCH AGRICULTURAL AND INDUSTRIAL POPULATION GROUPS, 1921

■ Areas of greatest concentration in industrial population
▨ Other predominantly industrial areas
▨ Areas mainly agricultural in population
☐ Areas almost purely agricultural
LILLE
LE HAVRE
PARIS
STRASBOURG
NANTES
BORDEAUX
LYON
MARSEILLE
CORSICA

MAP II

manufacturing equipment elsewhere than in the devastated north, the gains of the French were considerable. France began, therefore, her post-war career with two contradictory tendencies — one towards further impoverishment and the other towards greater material riches.

CHAPTER II

NEW BASES OF POWER

When once the economic position of France on the eve of the war has been described, the effects of the war noted, and the industrial consequences of the new peace conditions set forth, the question arises as to whether any new turn was given to the process of industrialization in post-war France.

Present-day economic life owes practically all of its distinguishing characteristics to the process of industrialization. Starting at the close of the eighteenth century in Western Europe, the tide of industrial transformation gathered tremendously in scope and intensity during the last one hundred and fifty years, so that to-day there is hardly a square mile of the inhabited globe which has not been more or less forcibly swept by it. The regions most profoundly affected are Eastern United States and Western Europe. At the time of writing (August 1928) the Far East is in the throes of dramatic conflict, as the irresistible influence of western industrial modes of life penetrates more and more deeply. The direction which industrial progress takes is determined, in practically all cases, by the presence of power resources, hard common metals and raw materials. Probably the most important problem of all nations to-day is that arising from the ubiquitous necessity of making constant readjustments to incessant changes in the technique of production.

The war of 1914–1918, as regards its effects on the process of industrialization, was a critical event for many countries, especially for France. Did not France acquire new power, new material resources, new manufacturing equipment, new inventions, etc.? How, then, did all these things affect her position as an industrial nation? It is the purpose of this chapter to evaluate the post-war acquisitions of France with reference to their contribution to the basic structure of the country's industrial development.

1. The Contribution of Alsace–Lorraine

The most important of the recent additions to the domain of France was undoubtedly Alsace-Lorraine. From the point of view of territory and population, the reannexed region was of relatively small consequence. It added to pre-war France not quite 3 per cent in area, and about 4.5 per cent in population. The real significance of the recovered provinces lay rather in the natural resources and industrial equipment which they contained.

The Coal and Iron Resources of Alsace-Lorraine

First of all, the province of Lorraine brought with it into France vast deposits of iron ore, the largest and richest in all Europe. As has already been observed in the preceding chapter, these beds of ore had been divided, before the war, between France and Germany. It was only after the Franco-Prussian war of 1870 that Germany had come into possession of her part of Lorraine containing 1.8 billion metric tons of iron ore resources, while France was left with 2.5 billion metric tons in the unannexed remnant of this province. At that time neither the quantity nor the significance of the French deposits was known, for the Thomas basic process of refining ore of high phosphorous content had not yet been invented and the Lorraine ore especially on the French side was regarded as practically useless because of its high percentage of phosphorous.

The value of Lorraine was further enhanced by the presence of coal in its subsoil. The great Saar beds tail off in this region, and the coal resources extending into what was formerly German Lorraine amount to perhaps 3.5 billion tons, roughly a quarter of the total Saar valley coal. Thus the reannexation of Alsace-Lorraine added about 20 per cent to the inadequate and much treasured coal supply of France.

The acquisition of these coal and iron deposits, which are the essential requisites of modern economic development, certainly strengthened the foundation of the industrial structure of France and provided a basis for an accelerated rate of industrialization. Still the mere presence of additional coal and iron was not at all sufficient to accomplish any vast industrial transformation. These basic substances had to be combined with other industrial materials to form part of the commercial stream of goods before they could add to the wealth of the French nation.

Changing National Boundaries and the Iron and Steel Industries of Lorraine

It is wholly inadequate to envisage the process of industrialization of a given nation uniquely from the point of view of the national resources in basic raw materials. Production depends essentially on an integration of numerous factors, such as power, steel, raw materials, labor, transportation, markets, etc., which must be all welded together into one great operation. All the necessary elements of this *ensemble* are never found together within any one set of national boundaries, but industry tends to develop most in those countries where there is the happiest coördination of the greatest possible number of requisite factors.

National divisions may, at times, favor industrial progress, in so far as national policies encourage production. National boundaries, however, are generally of long standing, and have been originally determined, for the most part, by tradition, language, religion, accidents of war, that is, by considerations having not the remotest relation to the present-day process of industry. As a result, these national frontiers often split up regions containing economic and other resources which for industrial purposes belong together. It is principally in the guise of tariff barriers that these boundaries exercise their pernicious influence — pernicious, of course, from the point of view of economic progress.

The detrimental effects of national boundaries are perhaps nowhere so obvious as at the crossroads of the Belgian, French and German frontiers. There, as it has already been observed, a remarkable geographical concurrence of natural elements stimulates industrial activity. Coal and iron are found in abundance; the population is dense and offers a plentiful labor supply; a great number of land and water routes converge there, raw materials of all sorts are within convenient reach, and numerous first-class markets are near at hand. It is no wonder that this region has become the most important industrial center of the European continent. There can be no doubt, on the other hand, that the development would have been much greater had not the very heart of this territory been partitioned by the boundary lines not only of Belgium, France and Germany, but of Luxembourg and the Saar as well.

Before the war of 1914–1918, the most intense industrial development took place in that part of this region which lay within the German borders, for the reason that no political economic barrier intervened between the iron of Lorraine and the immense coal deposits of the Ruhr. These two great resources, separated from each other by only a short distance, served as dual pillars, on which, to a large extent, Germany's vast industrial edifice of 1870–1914 rested.

Most of the iron mined in German Lorraine was either shipped as ore, or first refined in the local blast furnaces and then sent as pig iron into the Ruhr to be elaborated there, close to the coal supply, into various manufactured steel and iron products. In 1913, this part of Lorraine drew from its subsoil deposits 21.1 million tons of iron ore, but refined only about 11.2 million tons on its own soil, the rest having been sent principally to Westphalia, of which the Ruhr is a part.[1] Of the 3.9 million tons of pig iron tapped from the Lorraine blast furnaces of 1913, only 2.5 million tons were subjected to further transformation in Lorraine itself, the rest again being sent chiefly to Westphalia.

The iron mines of German Lorraine, equipped as they were before the war with elaborate and very costly apparatus, were exploited with a view to exporting out of the province an appreciable proportion of the ore. What remained was fed into 64 local blast furnaces, a notable part of whose product was in turn destined to be sent away, mainly to Westphalia.

Pre-war German Lorraine depended on the Westphalian industrial districts, not only as an outlet, but also as a source of the indispensable raw materials in iron and steel manufacturing, namely coal and coke. To be sure, there was a considerable supply of coal in Lorraine, but the production amounted to only 3.8 million tons in 1913, while the consumption that year was 11.1 million tons.

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[1] These figures and those that follow were taken from Ministère du Commerce, *Rapport général sur l'Industrie française*, Vol. II, p. 961 *et seq.*

The bond of coke was even stronger than that of coal in linking German Lorraine and the Ruhr into a single industrial unit before the war. Coke is the carbon residue of coal after the volatile oils have been in part removed, and its value lies in the fact that it constitutes an essential chemical element in the production of pig iron from the ore. It is indispensable to the manufacture of steel, too, for thus far no inventor has succeeded in producing steel directly from the ore without passing through the pig-iron stage. The great difficulty with coke for metallurgical purposes is that it cannot be made from any and all kinds of coal. There are only a certain few definite categories of coal that yield coke of sufficiently practicable size and strength to sustain the shock and weight of enormous masses of iron ore which are showered on it in immense blast furnaces. The coal of Lorraine, being rather rich in volatile oils, is not nearly as suitable for making metallurgical coke as the Ruhr coal. That is why in 1913 Lorraine obtained nearly all her coke (4.8 million tons out of 4.9 million tons consumed) from without. A natural system of exchange was thus set up between Lorraine, sending out iron ore and pig iron, and Westphalia, sending in return coal and coke.

The Treaty of Versailles, in bringing about the return of Alsace-Lorraine to France, undoubtedly redressed the political injustice inflicted when these provinces were wrested from her in 1871. The new politically equitable Franco-German frontier ran, however, right across and intercepted the trade routes taken by Lorraine iron going to the Ruhr and by Westphalian coal and coke consigned to Lorraine. When France recovered her lost provinces, what she acquired was not simply 1.8 billion tons of iron ore, and 3.5 billion tons of coal, but, in addition, the whole intricate and perplexing problem of adjusting the industrial equipment of Lorraine to new frontier and trade conditions.

As has just been seen, Lorraine had been developed under the German régime as a center for producing iron ore and pig iron in great quantities, and requiring, therefore, vast amounts of coal and coke. The size of the population of Alsace-Lorraine, the prevailing standard of living, the transport facilities, the accessory industries, etc., had all been built upon the basis of large-scale production. Such was the situation which confronted France when the reannexation clause of the Treaty was definitely decided upon. Knowing that her own coal mines which had been in occupied territory were left in a badly crippled state, with immediate productivity impossible, France demanded that she be given new coal resources, at least temporarily, so that her recently augmented metallurgical equipment might not suffer from the complete want of this essential substance.

The solution given to the problem consisted in handing over to France the coal mines of the Saar adjoining Lorraine. The Saar territory was detached from Germany and placed under the government of a special commission appointed by the League of Nations. This arrangement was to hold until 1935, when a plebiscite of voters would decide whether the territory should go back to Germany, or be united with France, or remain governed by the League of Nations Commission. If the voters should decide to return to their old mother country, Germany would be given the right to repurchase the coal mines from France. It was stipulated, furthermore, that Germany should furnish whatever additional supplies of coke were necessary for French industry. In this way an attempt was made to guarantee, for a time at least, the delivery of the missing materials indispensable to Lorraine metallurgy.

The chief value of the Saar, thus temporarily and indirectly annexed to France, lay in its resemblance to the Ruhr. The only drawback was that the Saar coal was not as suitable as Ruhr coal for making the kind of coke needed in modern blast furnaces. Nevertheless, even before the war, the economic relations between the Saar and Lorraine were hardly less intimate than those between Westphalia and Lorraine. In 1913 all the iron ore (3 million tons) consumed in the Saar, as well as three-eighths of the required pig iron, came from the outside, and at the same time nearly 60 per cent of the coal dug from her mines was sent out of the territory. When France came into possession of the coal mines of the Saar in 1919 the loss of some of the coal which used to come from the Ruhr was to some extent compensated, but the former Ruhr coke deliveries could not be substituted in this way.

The problem of obtaining raw material to feed into the great plant equipment of Alsace-Lorraine was not the only one with which France had to cope. There was also the very difficult task of finding profitable outlets for the products, since they were not and could not be all consumed by the small population of Lorraine. For example, before the war, Lorraine consumed only about 10 or 12 per cent of her steel production. In other words, while Lorraine fairly bristled with blast furnaces for transforming iron ore into pig iron, and possessed also numerous mills for converting pig iron into steel, there were relatively few plants for the further elaboration of steel ingots into various steel products. It was, therefore, necessary to send out nearly 90 per cent of the raw steel to be made up into finished products elsewhere. One of the current explanations offered to account for this stunted development of the steel-products industry is that the Germans deliberately planned it, preferring to place such plants farther from the French border. It seems more probable, however, that the machine-construction and other metal-trades industries were situated in Westphalia rather than in Lorraine simply because the former had more coal mines, and coal was required in large quantities for the final elaboration of manufactured steel goods. When, therefore, the Treaty of Versailles separated Lorraine from Westphalia, the new situation raised serious marketing difficulties as well as problems in the co-ordination of raw materials.

It is clear, too, that the post-war Franco-German relations must have played an important rôle in the complicated series of adjustments which had to be made when Alsace-Lorraine was reincorporated into France. The new situation of France as compared with that of Germany was one that would be expected to give the former a considerable lead over the latter. By the provisions of the Treaty of Versailles Germany lost most of her iron supply and found the organization of her heavy steel production badly disrupted through the loss of Alsace-Lorraine and the cession of the Saar. From the economic point of view she lost, in addition, the Duchy of Luxembourg, which before the war had been in a customs union with Germany and after the war was linked with Belgium. The consolidation of the advantages which France thus gained over Germany was contingent, however, both upon obtaining an adequate supply of coal and coke, and upon finding good markets. Nor was the task of France limited to ferreting out buyers for her pig iron and steel ingots. If she was to solidify her industrial foundations, she had also to build more factories for transforming the raw metals into manufactured products, and then find outlets for these products as well. The extent of French progress along these lines will be described in greater detail in the later chapters dealing with coal and metallurgy.

If the Franco-German relations had been more favorable to the leveling down of the economic barriers between the two countries, it is very probable that the general tendency in the industrial organization of the border region would have taken the direction of the same geographic integration which obtained before the war. The iron of Lorraine would have become more and more closely linked with the coal of the Ruhr, as well as with that of the Saar, of northern France and of Belgium. Since this tendency is inherent in the natural subsoil conditions, its force was felt after the war, in spite of the intervening national frontiers. Thus one possible solution for France, in her endeavor to profit by the newly acquired industrial equipment and resources, might have been to encourage these natural tendencies. The result would have been a probable gain to both France and Germany, but a relatively greater gain to Germany because of the superior importance of coal in the elaborative metal trades as well as in the early metallurgical processes.

A more nationalist alternative presented itself to France, and was in effect adopted. This consisted in encouraging the development on French soil of those industries which carry the raw iron and steel on to the finished manufactured product. It was planned also to render France as independent as possible of Germany with respect to coal, by intensifying the production of the old French coal mines as well as of those of Lorraine and of the Saar. There was a limit to what could be done this way, however, because it did not seem wise to push the exploitation of existing mines too far and too rapidly, out of consideration for the future. Furthermore, in the absence of any invention which would make possible the utilization of French coke for metallurgical purposes, it was out of the question to try to obtain the needed coke exclusively from French sources. The shortage of French coal and coke proved to be a real handicap in the pursuit of any policy of economic autonomy. Nor could France conveniently draw on England's rich resources, for the importation of coal from across the Channel into Lorraine was more expensive than getting coal from the Ruhr only a short distance away.

Though France endeavored to pursue the policy of national economic independence, especially with respect to Germany, the pressure of circumstances seemed to be working in the opposite direction toward an agreement to coöperate with Germany, if the metallurgical equipment of greater France (including Alsace-Lorraine) was to be used at all fully. The Germans, too, contributed their share to this pressure. They retaliated against the French effort to avoid any industrial association with Germany by tending as far as possible to refrain from importing Lorraine iron ore. When they had to import pig iron, they sought it in countries other than France. The Lorraine metallurgical industry, of which the whole *raison d'être* from the beginning had been the German market, was in this way certainly retarded in its post-war development.

On the other hand, a more friendly industrial relationship between France and Germany, while it would undoubtedly have put production on a more rational and efficient basis, would at the same time have aggravated the marketing difficulties. Although production was cramped by the effects of the new international boundaries, adequate markets were still hard to find even for the limited output. The post-war markets of the world, handicapped by depreciated, unstable currencies, and barricaded behind tariff walls raised high in an atmosphere of war-accentuated nationalist sentiments, were not in any position to absorb even what they had taken before the war. How, then, could manufacturers have disposed of the highly increased volume of production which might have resulted from a coöperative arrangement between Lorraine and the Ruhr?

A possible solution of the marketing problem might have been attained by increasing the capacity of France herself to absorb the enlarged output of steel. Here, however, was a vicious circle. The development of France as a market for steel products was dependent upon an intensification of the industrialization of France, which in turn hung on an adequate supply of coal and coke, and on finding larger outlets both at home and abroad. Coal could in measure be taken from French soil, but not as economically as from German soil. The problem of markets was less easy of solution, for it had to wait on a world-wide general economic recovery and development of trade.

The acquisition of Alsace-Lorraine increased the possibility of further industrialization in France. The realization of these greater opportunities called for a multitude of delicate economic adjustments and important decisions of vital policy. This was certainly the key problem of the post-war economic development of France, though perhaps less dramatic and less spectacular than her currency problem.

Other Natural Resources of Alsace-Lorraine

The reannexation of Alsace-Lorraine gave France not only iron and coal resources, which, important as they were, could not by themselves carry the post-war industrial development of the country very far. The recovered provinces contained other forms of economic riches, the most notable among them being the valuable beds of potash in Alsace. Potash is one of the trio of chemical fertilizers (potash, nitrates and phosphates) which replenish exhausted soil with the elements necessary for its continued utility to agriculture. The potash resources of the world are so unevenly distributed that before the war Germany, with her Alsatian and Stassfurt beds, enjoyed a practical monopoly of the substance. In 1913 the mines of Alsace yielded about 50,000 tons, of which only 3,000 tons were consumed in Alsace-Lorraine. The Germans, finding their Stassfurt mines more economical to exploit, attached only secondary importance to the Alsatian resources and made no effort to develop them fully. When the French took over these mines, they obtained, therefore, a natural resource the production of which could be greatly expanded. At the same time they came into possession of a substance invaluable to French agriculture.

The subsoil treasures of Alsace contained oil too. This was of especial significance to France, because no oil had been discovered anywhere in the rest of the country. The most important wells were concentrated near the town of Pechelbronn. In 1913 the yield was 20,000 tons in terms of crude oil, and this was increased under Germany's war régime, by the drilling of additional wells, to nearly 50,000 tons in 1918. During the post-war period many soundings were made, but only one in five proved to be productive. The production was raised to 70,000 tons in 1924, but this was less than 2 per cent of the oil consumed in France in that year. The oil-refining equipment was constantly enlarged to keep pace with the increasing yield. Under such conditions there could obviously be no difficulty in marketing the national yield.

Industry and Commerce in Alsace-Lorraine

The economic importance of Alsace was not merely a matter of mineral resources. The textile industries played as important a rôle in this province as the mining and metallurgical industries in Lorraine. Before the war the artificial silk industry was as extensive in this small region as the same industry in the whole of France. In the way of equipment for cotton manufacturing, Alsace contributed to France about two million spindles representing an increase of 25 per cent over the number of spindles in smaller France (without Alsace-Lorraine). It added also about 33 per cent to the number of French cotton looms, and more than doubled the number of calico-printing machines. The productive capacity of the French wool industry was increased in a general way by about 25 per cent, thanks to the reincorporation of Alsace into France.

As in the case of the metallurgical industry of Lorraine, this tremendous gain in plant equipment was by no means an unmixed blessing, for it gave rise to the extremely perplexing problem as to how to dispose of the increased product. Before the war Alsace-Lorraine had consumed only a small portion of the immense quantity of textiles produced in the region. Most of it — from 80 to 85 per cent — was consumed outside, especially in Germany. This was not unknown to the negotiators of the Treaty of Versailles. They saw clearly that an abrupt economic separation of Alsace-Lorraine from Germany would be disastrous to the industrial welfare of these provinces. Accordingly they stipulated for the duty-free entry into Germany, during five years, of all products of Alsace-Lorraine in approximately the same quantities as had been transported there before the war. This constituted, however, only a partial solution of the marketing difficulties. In the course of the period of free entrance the reduced purchasing power of Germany acted very much as a tariff barrier. By January 10, 1925, Germany had erected enough new plants of her own to enable her to dispense with imported textiles, so that after that date she effectively excluded most of the Alsatian cotton and woolen goods.

There were, besides, a number of other branches of industry to which Alsace and Lorraine owed much of their economic importance. A mere enumeration of the principal manufactures gives an impression of great industrial versatility. This region produced, for example, beer, wines, liquors, sugar, canned foodstuffs, automobiles, bicycles, agricultural machinery, clocks, scientific instruments, other manufactured metal products, clothing, hats, shoes, furniture, paper, electrical equipment and chemical products. And the list makes no pretension to being exhaustive.

Alsace-Lorraine proved to be a great commercial asset. These provinces are rich in transport facilities which constitute the underlying physical basis for extensive commercial activity. Alsace is endowed with the ancient and splendid inland port of Strasbourg. Its tonnage in 1913 amounted to two million tons, and after the war, thanks to the important French improvements, the tonnage rose to two and a half million tons (1924). Coal, cereals and various other merchandise are unloaded from ocean vessels at Antwerp and Rotterdam into river boats and barges and taken up the Rhine to Strasbourg, the great eastern waterway gate of France. The outgoing tonnage consists largely of potash, but considerable quantities of other goods are also exported by this port. Situated at the dividing point between the more navigable lower Rhine and the less navigable upper Rhine which goes as far as Basel, Strasbourg is, by the nature of things, a busy station for the transshipment of goods. Furthermore, this city, in addition to being an inland port, is one of the most important railway centers of Europe, since it is at the junction of the international European lines from Paris to Vienna, from Marseilles to Berlin and from Basel to Amsterdam.

Agriculture in Alsace-Lorraine

Their mineral resources, their industries and their commercial facilities do not tell the whole story of the economic value of Alsace-Lorraine. The agricultural production of these provinces constitutes an essential contribution to the material welfare of the country. Although there were more persons in Alsace-Lorraine engaged in industry than in agriculture, the number engaged in agriculture represented nearly 80 per cent of the number engaged in industry. In 1911, the percentage engaged in agriculture in France was 115 per cent of the number engaged in industry. In other words, Alsace-Lorraine was before the war relatively less agricultural than France. Yet there were about half a million persons engaged in agriculture in these provinces.

The land of Alsace-Lorraine varies considerably in quality from place to place, the north of Lorraine being the least suitable for tillage. About 30 per cent of the total area is made up of forests, which is a notably greater proportion than that in the rest of France (19 per cent). In all, before the war, the ratio of cultivated to uncultivated land was somewhat smaller in Alsace-Lorraine (64 per cent in 1913) than in France (72 per cent in 1913).[2] The proportion of meadow and pasture land was about the same.

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[2] The distribution in 1913 was as follows:

General Use	*France*	*Alsace-Lorraine*
	(In hectares)	
Exploited agriculturally	36,542,664	929,461
Woods and forests	9,886,701	441,798
Other lands	6,523,214	80,861
	52,952,579	1,452,120

Alsace-Lorraine was not quite as specialized in the production of wheat and other cereals as was the rest of France. On the other hand, the acreage devoted to potatoes and sugar beets was relatively much greater in the recovered provinces than in the France of 1913. Alsace-Lorraine also had a slightly larger number of cattle per unit of agriculturally productive land, but fewer sheep than France. In the production of wines and forage crops France was relatively superior.[3]

Although the old medieval system of farms, broken up into scattered strips, still survives to a large extent in Alsace-Lorraine, and is, of course, unadapted to the modern technique of agriculture, the yield of cereals per acre in this region before the war was

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[3] Source: *Comptes-rendus statistiques — Office de statistique d'Alsace et de Lorraine, 1924*, fascicule n° 1–2–3, p. 30, and *Statistique Agricole Annuelle, 1921*, pp. 152–153.

These comparisons of the agricultural distribution in France and Alsace-Lorraine were taken from the statistics of acreage in the two areas (in 1910–1913 for Alsace-Lorraine and 1904–1913 for France) devoted to the crops listed below:

Crop	Areas (In thousands of hectares)		Percentage of the Total Areas	
	France (1904–13)	Alsace-Lorraine (1910–13)	France (1904–13)	Alsace-Lorraine (1910–13)
Wheat	6,540	138	20	17
Other cereals	7,007	131	22	17
Potatoes	1,631	92	5	12
Beans and peas	314	5	1	1
Flowers and truck-garden products	214	6	1	1
Industrial plants (sugar beets)	387	52	1	7
Vines	1,624	30	5	4
Forage crops	4,925	95	15	12
Pastures and meadows	9,885	229	30	29
	32,527	778	100	100

There were in France in 1913, 14,788,000 heads of cattle and 16,131,000 sheep, and in Alsace-Lorraine there were in 1912, 523,000 heads of cattle and 46,000 sheep.

very much greater than in France.[4] Nevertheless, the reannexation of Alsace-Lorraine did not bring France any nearer to the realization of the desire of certain of her citizens to render their country independent of imports for food and other agricultural products. The mere addition of 3.75 per cent to the production of cereals, of 3.5 per cent to the number of cattle, and of 1.7 per cent to the production of forage crops fell considerably short of being proportionate with the increase in population (4.5 per cent) which accrued to France with Alsace-Lorraine. The reason is fairly clear when it is recalled that there were more persons in the region engaged in industry alone (exclusive of commerce and the liberal professions) than in agriculture. The union of Alsace-Lorraine to France in 1919 thus shifted the balance between industry and agriculture, adding to both, but strengthening industry relatively more than agriculture.

2. New Colonial Resources

From the economic point of view, the immediate gain to France resulting from the cession of former German colonies in 1919 was very slight. The ultimate value of these territorial accretions depends largely upon their future agricultural and industrial development and upon the discovery of natural resources yet unknown. The French domain in Equatorial Africa was enlarged by about 15 per cent through the complete and direct cession of a portion of the former German Congo. This consisted really of a return of territory which the French had ceded to Germany by diplomatic arrangements in 1911. Two other neighboring German colonies, Togo and Kamerun, were assigned indirectly, under the mandate system, to Great Britain and to France, each power taking a portion of these colonies for protection and development. The part of the Togo under French mandate has an area of 20,000

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[4]

Crop	*Yield in France (1913)*	*Yield in Alsace-Lorraine (1913)*
	(In metric quintals per hectare)	
Wheat	13.3	17.4
Oats	13.0	18.6
All cereals	12.9	17.7

square miles and a total population of 765,000, of whom only about 150 are Europeans. The portion of Kamerun over which France acquired mandatory powers is larger than the French Togo, but not so densely populated: 166,000 square miles, containing an estimated population of 2,800,000 natives and approximately one thousand Europeans, half of them living in Douala, a city of 30,000 inhabitants.

The economic value of these colonial possessions beyond the seas is to be measured principally by their natural resources and trade. Their commercial activity is dependent upon their relative proximity, not only to the mother country, but to other trading nations. So far as is known, their mineral resources are negligible, no coal or oil having been as yet discovered. A little iron is found in French Equatorial Africa, and worked in primitive ways by the natives. Gold, graphite and mica are mined to some extent in Kamerun. These tropical regions are, however, essentially agricultural, and are given also to cattle raising. The nature of their exports, consisting principally of almonds, cocoa, palm oil and wood, is simply a consequence of the agricultural activity of the country. In a similar way, their imports, made up of cotton cloth, clothing, salt, beverages and tobacco, indicate an almost complete lack of industry. The total foreign trade of the mandated territories of Togo and Kamerun amounted to 257 million francs in 1924. Less than a third of the foreign commerce of Kamerun was with the mother country. Furthermore, from the point of view of France, the exchange of goods with Kamerun was insignificant, representing in value not even one-hundredth of one per cent of the total French foreign trade. Togo is regarded as an eventual source of cotton, and experimental stations have been established there to study the possibilities.

It was not only at the expense of Germany that the French colonial possessions were enlarged after the war. Germany's ally, Turkey, was also forced to cede large portions of her empire, and in this way Syria went to France as a mandate.

Syria is a large populous territory, extending over 58,000 square miles and inhabited by over two million people. Almost a third of the population live in cities, three of which have over 90,000 inhabitants each. Among the natural advantages of this mandate are its temperate climate, its sea coast, and its excellent ports. There are, however, no resources of coal or oil. Small quantities of iron, copper and mercury are the only minerals found. In fact, Syria is primarily an agricultural country producing mainly cereals. The yield per acre is rather low, and the crop varies in size considerably from year to year because of the erratic climate. In addition to cereals, Syria produces oleaginous plants, fruit, cattle, and silk worms. Unlike the tropical colonies, this Mediterranean mandate has a certain amount of industry too. Textiles, vegetable oils and soap are among the principal articles of Syrian manufacture. The railways which are mainly concentrated near the sea coast are about a thousand miles in length. Thanks to the automobile, rapid communication with the vast but less developed eastern region is becoming more and more feasible.

The value of the exports and imports of Syria in 1924 surpassed 1,136 million francs, but the commerce with France constituted a very small part — less than 15 per cent. Only about two-hundredths of one per cent of the total foreign trade of France was with Syria. The chief exports consisted of silk-worm cocoons, silk fabrics, fruit, cattle and vegetable oils; and the main imports comprised cotton cloth, sugar, rice, machines and automobiles. The presence of manufactured products in both imports and exports is always an indication of a certain degree of industrialization.

It is interesting to note, however, that the new colonial domain (including mandates) which accrued to France after the war added little to the economic power of the mother country. Syria is perhaps richest in potentialities of future value to France. It resembles the North African colonies, particularly with respect to the constant development of European standards of consumption, and also as an increasingly important source of food supplies.

3. New Stimuli to Industrialization

Despite the modest measure of the economic contribution which the added French territories beyond the seas brought to the mother country, these together with Alsace-Lorraine made post-war France industrially stronger in many respects than she had ever been before. The growth of France after the war is impressive not only in comparison with what she had been before the war, but also in comparison with the economic development of some of her neighbors. The aggrandizement of France took place largely at the direct expense of one of her principal competitors, Germany, who lost contiguous territory, colonies and population. On the east to France and on the west to Poland, Germany was forced to cede regions which had formed integral and very important parts of her national economic structure. The Austrian Empire, too, was broken up, and the industrial and commercial vitality of its constituent parts was sorely reduced. As a consequence France emerged after the war head and shoulders above some of her former rivals.

It has been observed that the net effect of the reannexation of Alsace-Lorraine was to add more to the industrial than to the agricultural capacity of France. This was an important step in the process of industrialization, which, in final analysis, consists mainly in the relatively greater development of manufacturing activities as compared with the tillage of the soil. The new colonies and mandates also added something, however infinitesimal, to France in the way of markets for manufactured products and sources of food supplies and raw materials.

More or less directly as a result of the war, France was enriched industrially here and there within her old 1913 frontiers. The war gave a tremendous stimulus to those old branches of French manufacture engaged in making armaments and army equipment of all kinds. The mining and metallurgical industries towards the south, around Lyons, and those in Normandy all took on unprecedented proportions under the influence of the extraordinary war demand. The effects of this stimulus reached out through these industries to a large number of related fields of production. A great impetus was given, for example, to the chemical, canning, and shipbuilding industries. Moreover the shortage of man power accentuated the use of machines.

On the other hand, the war destroyed and crippled many industries — especially those which were concentrated in the north of France. The disastrous effects were, however, only temporary, for the shattered plant equipment was soon replaced by new machinery more modern and more efficient than the old. Nevertheless it took several years to clear the wreckage and build new factories. This proved to be very costly to France. By 1925 it was practically all completed and the industries that benefited most by the Phoenix-like revival were mining, metallurgy and textile manufactures.

Still another driving force intensifying the process of industrialization in France was derived from sources not so intimately related to the war. These were inventions, some originating on French soil and others coming from abroad. The general spirit of coöperation which animated the Allies in the course of the war led to a somewhat more liberal interchange of inventions than would otherwise have been the case. And besides, during the period of strife, the belligerents felt free to ignore the property rights attached to their enemies' patents. Under the pressure of tremendous war-time demands for goods, new schemes for the more efficient organization of factory work were developed. Thus, for example, the Taylor and similar systems were introduced into France during and after the war.

There were certain industries that grew in size and production quite independently of the war, simply because they were new and turned out commodities for which the demand increased by leaps and bounds. Such was, for example, the artificial silk industry, which had been still in its infancy in 1913, but which developed very considerably in the post-war years. In a similar way, hydroelectric plants grew in size and number, simply because this industry was moving through phases of rapid evolution in the post-war years. The same is true to a certain extent of the chemical industry, but here, as we have shown, the impetus of the war played a large rôle.

As indicated in Chapter I, there was room for much industrial progress in pre-war France, if that country was to attain the levels reached by the United States, England and Germany. The statistics of trade, of the consumption of coal, of the production of steel and consumption of iron and steel manufactured products, show that France had been moving ahead rapidly in the decade which preceded the war. After the tragic interval from 1914 to 1918, it was to have been expected that this movement would soon get under way again. The new stimuli to industrialization which came to France after the war made this resumption of progress seem even more probable.

Industrialization is, however, contingent upon a multitude of factors, many of which are not industrial at all. It is always necessary, for example, to find adequate markets both at home and abroad. Another fundamental requisite of industrialization in France is an abundant supply of coke. And for this France is dependent on Germany and will continue to be so, unless some new method for fabricating coke is discovered, or unless new blast furnaces are made adaptable to such coke as can be manufactured from French coal. Furthermore, even the coal used as such must be obtainable cheaply, if France is to make rapid strides as an industrial nation. It must be sufficiently cheap and abundant to enable French manufacturers of finished steel products to compete with German and English competitors.

Markets, coke and coal are not the only factors on which industrial progress depends. An abundant and capable labor supply is no less essential. It is frequently argued that French laborers love skill too well, and are too temperamentally opposed to the refined subdivision of tasks and to the type of monotonous work prevalent in modern factories to allow France to go very far on the path of mass production. The labor supply, however, is not made up of permanent units; it is rather a continuous passing stream, and human beings have proved everywhere to be remarkably adaptable. In such industries as are characterized by mass production in France, French labor has been found to adjust itself very well to the new situation.

The constantly declining birth rate of France has led to gloomy forebodings with regard to the future of the French labor supply. The supply of labor is not, however, exclusively dependent on a rapidly increasing birth rate. The need for workers may be met by a lowered death rate and by immigration. Most of the countries of Europe are overpopulated in the sense that they are seeking outlets for their emigrants. This excess of population can be easily drawn on by France. In so far as there is a reluctance on their part to encourage immigration, the French will be forced to develop machine production, and the greater use of machines is an integral part of the process of industrialization.

The new resources added to France, the new tendencies, stimuli and incentives arising from the war and from the general industrial progress that comes with time, all point toward ever greater industrialization. The underlying bases of industrial power are certainly present. There are formidable obstacles, to be sure, but it seems probable that the post-war greater France will rapidly rise to high rank as an industrial nation.

CHAPTER III

CURRENCY DISTURBANCES

With her increased industrial power and extended colonial domain post-war France might have been expected to move rapidly and easily toward enhanced well-being and greater material prosperity. This was far from being the case. The new productive potentialities form only part of the picture. The military glory with which victorious France was covered at the close of hostilities hardly concealed her appalling burden of economic ills. What with diminished resources of capital for investment, increased taxation, the obligation to amortize huge loans issued to prosecute the war, the devastation of valuable industrial areas, the impoverishment of markets, the disruption of the European economic organism of which French industry forms an integral part, the erection of new tariff barriers, and the dizzy dance of unstable currencies, the outlook for the future was indeed most dismal.

It is one thing to have acquired an abundant supply of iron ore, and it is quite another thing to make large profits from the sale of great quantities of steel products derived from these ores. More generally, also, the mere addition of economic resources does not necessarily bring with it their successful exploitation. The problem of how far the exhausting and oppressive economic inheritance of the war has offset the gain resulting from the new industrial assets will be treated in the succeeding chapters.

In France financial difficulties have been among the most serious obstacles in the way of a prosperous realization of the latent industrial possibilities. Although it is outside the province of this volume to study the French financial situation during the post-war years,[1] so closely have the fortunes of finance and industry been interwoven, that the industrial history of the country during the period can hardly be made intelligible without some review of the currency disturbances and related economic phenomena.

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[1] For details, see Volumes I and II of this series: Robert M. Haig, *The Public Finances of Post-War France*, and James Harvey Rogers, *The Process of Inflation in France*.

1. The Instability of the Franc

The most striking feature of French economic life since the war is the instability of the franc, together with correlated fluctuations in government borrowings and private investments. The general depreciation of the franc is not difficult to describe, nor are its principal causes hard to trace. Many of the direct and indirect influences can even be measured with some precision. There are, however, peculiarities of the currency variations about which a great deal of uncertainty exists. Furthermore, the logical relation between these monetary disorders and industrial prosperity or depression is far from having been exactly determined. Still the story of the post-war industrial life of France cannot be really appreciated outside of its financial setting.

Most countries before the war had relatively stable currencies. This does not mean, of course, that the quantity of any specific commodity given in exchange for a definite sum of money may not have varied even within wide limits at short intervals of time, depending upon the changing conditions of supply and demand of that particular commodity. It does mean, however, that the amount of all goods, taken as a whole, which a given number of monetary units was able to buy remained about the same over a fairly long period. The economic importance of this stability of currencies lay in its assurance of contract and investment values and also in the security given to the purchasing power of savings. Modern industrial life has been built upon a basis of moderately stable money, which was found to be essential to orderly production, investment and trade.

No currency has ever been absolutely stable. Even very considerable changes in purchasing power were noted over long periods of time through the nineteenth century, but these operated slowly and almost imperceptibly. There were also sudden limited fluctuations upwards and downwards which took place periodically as business conditions shifted from prosperity to depression and vice versa. These changes, though serious at the time, now seem almost insignificant as compared with what has happened to the currencies of the belligerent nations and of their neighbors during the war and since.

The Decline of French Currency in Terms of Commodities

Although French money after the war did not depreciate, with respect to the quantity of goods its units could buy, to anything like the extent of the currencies of Central and Eastern Europe, still the diminution in the purchasing power of the franc was of considerable importance. It reached its lowest point in the summer of 1926 when it was worth only one-eighth of its pre-war value in terms of commodities. This fall was not precipitate, but rather gradual, spread over about a dozen years. And yet its repercussions on the economic and industrial life of the country were fundamental.

At the close of the war, the franc could buy only about 30 per cent of the wholesale goods it had been exchanged for in 1913.[2]

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[2] The wholesale price index number for France in January 1919 was 348, on a 1913 base. The French official index number of wholesale prices published by the *Statistique Générale de la France* has for its base the period 1901–1910, when prices were somewhat lower than in 1913. Since most of the comparisons with production and other data relate to the year 1913, it was found desirable to have a price series dating from that year also. The index numbers with the base 1901–1910 were adjusted to the base 1913 by dividing the monthly indices after 1913 by the 1913 index number calculated on the 1901–1910 base. There is a slight error involved in this procedure, for the French index number — unlike the United States index number of wholesale prices — is constructed by taking the unweighted arithmetic mean of relatives, a relative being the price of a particular commodity in a given month divided by the price of the same commodity in the base period. The error in thus changing the base is probably much below the error resulting from the small number of samples used in calculating the French index. The same method of changing the base was followed by the *Statistique Générale* in constructing index numbers with the base, July 1914, from their series with the base 1901–1910. The League of Nations also uses the same procedure in adjusting the French official index number to the 1913 base.

The French wholesale price index number is made up of the prices of 45 articles, 20 of which are foodstuffs, and 25 industrial materials, almost all in the raw state. This index number may, therefore, be criticized as being somewhat unrepresentative. It is, moreover, very probable that general wholesale prices did not really rise as high as this index number would indicate, because imported articles and raw materials fluctuated more widely in price than most commodities. See Vol. II of this series, James Harvey Rogers, *op. cit.*, p. 57.

Thereafter it fluctuated in purchasing power between the high point 36 per cent (February 1922) of its 1913 level, and the low point 12 per cent (July 1926).[3] The following column of figures shows the average year-to-year changes in the value of the franc measured in terms of wholesale commodities:

IMPT.

Year	*Index of the value of the franc in terms of its wholesale purchasing power*
1913	100
1918	29
1919	28
1920	20
1921	29
1922	31
1923	24
1924	20
1925	18
1926	14

In the above annual fluctuations the more extreme month-to-month variations have been smoothed out. The shorter-period movements are significant, however, because of the frequent dramatic changes in direction upwards and downwards taken by the purchasing power of the franc at most irregular intervals. After the war the franc steadily lost in value until September 1920 when it reached the low point of 19 per cent of its 1913 exchange value with respect to wholesale commodities. Then during 1921 and 1922, which were years of world-wide business depression, it rose to 36 per cent of its 1913 value, only to decline again in 1925 and through the first eight months of 1926. This second drop was at first gradual but toward the end it increased in speed, and in August 1926 it dropped with terrifying rapidity to 12 per cent of its pre-war value. In that same month, with the advent of the Poincaré Ministry, the franc began to rise again, and in April 1927 it attained the level of 16 per cent of its 1913 purchasing-power value.

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[3] Unless otherwise indicated, all wholesale price indices and all measurements of the purchasing power of the franc mentioned in the text were computed on the 1913 base according to the method described in the preceding note.

The Decline of the Franc in Terms of the Dollar

While the value of a currency is generally determined for most purposes by its purchasing power in terms of commodities, it is also frequently measured by the quantity of other moneys for which units of the given currency may be exchanged. Thus an important index of the fluctuations in the value of the franc is found in the varying amounts of a gold currency, such as the dollar, which the franc can purchase from time to time. Foreign money exchange rates are quoted on the Paris Bourse at short intervals during the day, unlike composite commodity price quotations which are available only monthly, and that after some delay. In periods of particularly great instability the foreign exchange rate, rather than commodity purchasing power, becomes the popular index of the fluctuation value of the franc.

Before the war foreigners used to purchase French currency in order to buy commodities and securities in France, or to pay for freight or insurance or tourist expenses; in any case, they bought it as a means to an end distinct from the money itself. When the franc became unstable after the war, then foreigners saw an additional purpose in buying this currency. They could speculate on anticipated fluctuations. Those who were interested in exports and imports found they could speculate doubly, once on the unstable foreign exchange value of the franc, and again on its varying purchasing power with respect to particular commodities. All these speculative purchases and sales of the franc served to amplify its oscillations in value. The French Government at different times during the war and the post-war period attempted to counteract the wider fluctuations through systems of artificial control over the foreign exchange market. Up to March 1919 the franc was "pegged" close to par with the aid of the American and British Governments. And later there were several long periods when the sale of French francs was not wholly free. Through this maze of forces and counterforces, not least among which were the purchases and sales of stable currencies by the French public, the exchange value of the franc with respect to dollars fluctuated in the following fashion during the post-war period:

Year	*Index of the value of the franc in terms of dollars*[4]
1913	100
1919	71
1920	36
1921	39
1922	42
1923	31
1924	27
1925	24
1926	17

It is interesting to observe that the foreign exchange value of the franc rose in very much the same way as its wholesale purchasing power during the years of business depression in 1921 and 1922, only to fall again in 1923.

A Comparison of Commodity and Dollar Values of the Franc

A comparison of the two columns of indices given reveals that the decline in the purchasing power of the franc with respect to the dollar, and its fall in value with relation to wholesale commodities were far from being identical. The principal reason for this is that in the post-war period the dollar itself lost some of its 1913 value in terms of what it could buy in the United States. The commodities, the prices of which are considered in comparing the purchasing power of the franc at different times, remained to all intents and purposes the same commodities in 1925 as in 1913. On the other hand the dollar, which is the standard for measuring variations in the exchange value of the franc, was not at all the same in 1925 as in 1913. This explains why, for example, the 1925 purchasing power index of the franc was 18, while the dollar exchange index of that year was 24.

In order to avoid the error involved in utilizing a fluctuating standard, comparative measurements may be made consistently on the basis of the dollar endowed with a 1913 purchasing power.

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[4] For the value of the dollar in terms of the franc, see J. H. Rogers, *op. cit.*, p. 59.

To be sure, such dollars never existed for purchase or sale after 1913, but if it be theoretically assumed that they were exchanged for francs during the post-war period, the decline in the ability of the franc to buy these 1913 dollars is shown in the first column below. In the second column the indices of the wholesale purchasing power of the franc are given for purposes of comparison.

Year	*Index of the value of the franc in terms of 1913 dollars*[5]	*Index of the value of the franc in terms of its wholesale purchasing power*
1913	100	100
1919	33	28
1920	16	20
1921	27	29
1922	28	31
1923	20	24
1924	18	20
1925	15	18
1926	11	14

Although there is a notable similarity in the movements of the two series, it is clear that the hypothetical exchange value of the franc in terms of 1913 dollars fell more, in the post-war period, than its synchronous command over wholesale commodities. The converse being also true, the dollar, the value of which evidently rose higher in terms of francs than the French price level in terms of the United States price level, possessed a greater purchasing power in France than in the United States. This would be expected to have a stimulating effect on the purchase of general commodities in France by the United States, that is to say, on exports from France to the United States. And so also with other countries, to the extent to which their exchange rates with the franc gave their currencies a favorable purchasing advantage in France, one would logically anticipate an increase of French exports in their direction.

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[5] Computed by multiplying the index of the value of the franc in terms of the dollar by the ratio of the 1913 United States wholesale price index (100) to the United States price index of the year considered. The index used was that of the Bureau of Labor Statistics.

Causal Factors

The general similarity of direction in the movements of the two values of the franc, the first in terms of 1913 dollars, and the second in terms of wholesale commodities suggests a causal relation. Either the changing price level brought about the fluctuations in foreign exchange rates, or the exchange rates were at the bottom of price variations, or else both these movements were caused, in large part, by other outside factors. Precise estimations of these causal relationships can be made only after considerable detailed analysis, which is not appropriate to the purpose of this chapter.[6] It seems probable, *a priori*, that the general price level affected the rate of foreign exchange. In the more acute stages of inflation it appears, however, that the reverse was true, namely that foreign exchange rates exercised a determining influence over prices.

It is possible to maintain still another hypothesis, namely, that the fluctuations of the franc with respect to the 1913 dollar and with respect to commodities were both the result of the general increase in the quantity of money in circulation in France. In so far as prices are determined by the ratio between the amount of goods and the amount of money to be exchanged, they naturally vary whenever the quantity of money changes without a corresponding change in the volume of goods. The quantity of money having increased in post-war France disproportionately with the variations in the volume of commodities, a rise in wholesale prices resulted. In 1913 there had been about 5.6 billion francs' worth of bank notes in circulation and also metallic money which has been variously estimated at about 5 billion francs, making, in all, a total of some 10.5 billion francs. In 1919, the bank notes in circulation amounted to about 34.8 billion francs (the annual average of selected end-of-month reports of the Bank of France),[7] represesenting an increase of approximately 330 per cent over the 1913 circulation. In the meantime the French wholesale prices had risen about 360 per cent. In 1925 when the bank-note circulation was more than four times as great as that of 1913, wholesale prices were five and a half times higher. The yearly averages of the increase in circulation and the rise in wholesale prices are indicated in the following table:

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[6] See particularly: J. H. Rogers, *op. cit.*, Aftalion's *Monnaie, Prix et Change* (Paris, 1927) and Borde's *The Austrian Crown* for analysis of the French and Austrian experience.

[7] *Cf.* J. H. Rogers, *op. cit.*, p. 62.

Year	*Index of the quantity of money in circulation*	*Wholesale price index*
1913	100	100
1919	332	356
1920	361	509
1921	356	345
1922	343	327
1923	353	419
1924	380	488
1925	421	550
1926	506	703

Apparently, in the course of the eight post-war years considered, there was a great expansion in the quantity of money in circulation (5 times), and a still more important increase in wholesale prices (7 times). Prices rose with the volume of money in 1919 and 1920, fell with it in 1921 and 1922, and rose again from 1923 to 1926 as the monetary circulation swelled. It is clear, however, that the movements of the two series given above have only followed the same general trend, without coinciding, for the fluctuations in the case of prices were much wider than the variations in the amount of bank notes. It would be difficult to conclude, therefore, that the increase in the volume of money in circulation fully explains the rise of prices and hence the decline in the value of the franc.

The price variations could, in fact, hardly be expected to correspond exactly with the changes in the quantity of money because the fluctuations in the quantity of goods bought and sold is another factor in the ratio determining oscillations in prices. An increase, for instance, in the quantity of commodities on the market, all other things being equal, tends to lower prices, and vice versa. But this is not all. Another circumstance affecting prices is the rapidity with which money circulates. If the same amount of money is used twice as rapidly, that is, for double the number of purchases and sales, in a given period, than in a preceding period

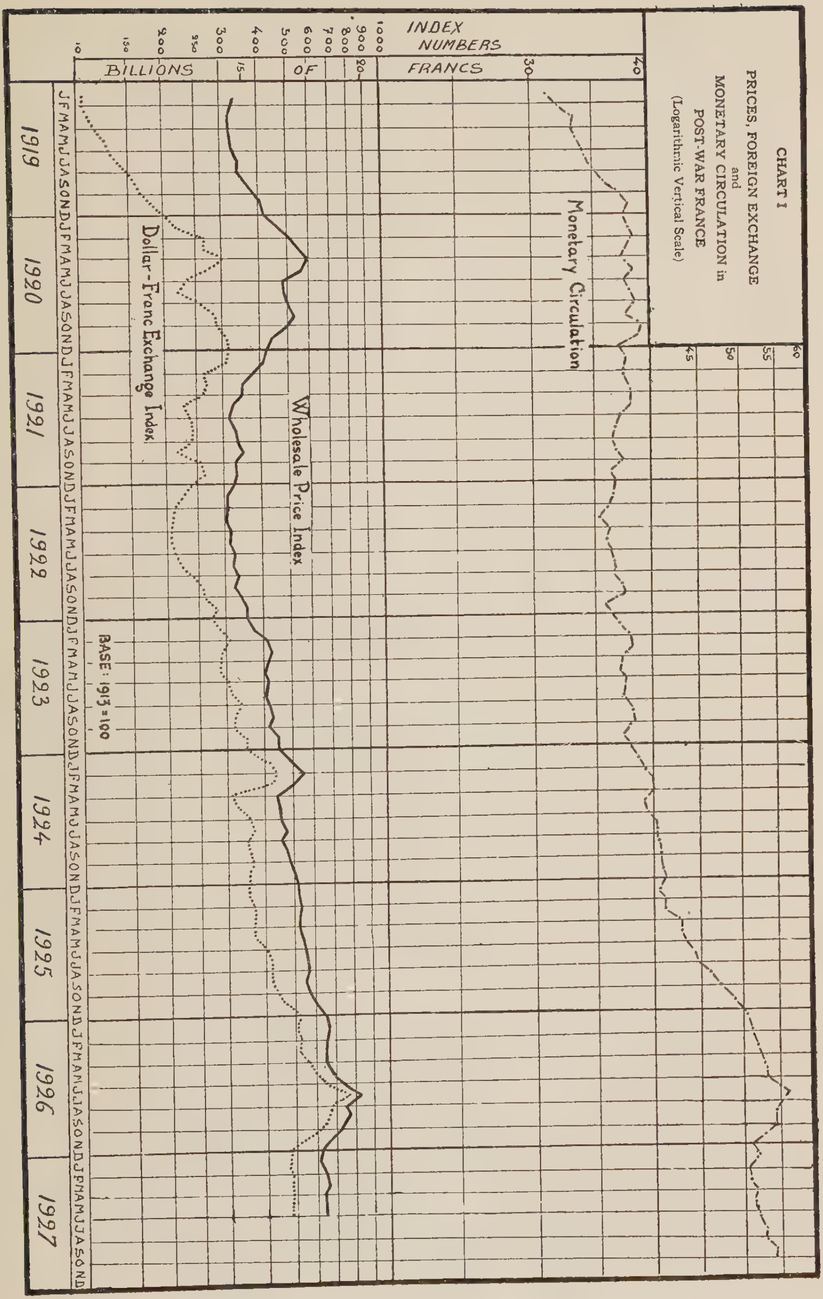

CHART I

PRICES, FOREIGN EXCHANGE
and
MONETARY CIRCULATION in
POST-WAR FRANCE

(Logarithmic Vertical Scale)

of equal length, it is as if the quantity of money were doubled, and prices consequently tend to rise. Furthermore, price movements are influenced by several other causes, more or less closely related to those already mentioned. In periods of acute monetary disorder, foreign moneys and credit instruments frequently get into circulation side by side with the inflated currency, and at such times the velocity in the exchanges of money for goods tends to increase greatly, at least for short periods.

Notwithstanding the number and extreme complexity of the factors involved, it is not unreasonable to conclude that the tremendous rise in prices or fall in the value of money in post-war France is due in large part to the extraordinary swelling in the volume of money in circulation.

2. The Mechanism of Monetary Inflation in France

Loans Made to the Government by the Bank of France

The question which next arises is that concerning the manner and purpose of these increases in the quantity of money in circulation. One of the methods, generally very rare, but to which the French Government resorted only too frequently during and after the war, consisted of advances to the State. These loans came from the Bank of France, one of the functions of which is to issue paper francs. In times of great stress when the yields from taxation and from the sale of bonds did not provide enough to meet budgetary deficits and temporary emergencies, the Government authorized the Bank to increase its bank-note issue, the proceeds going to the State. These were loans, bearing interest, but secured solely by the Government's promise to pay.

In 1913 the statements of the Bank of France contained no item called "advances to the State," for the simple reason that no such loans existed at the time. This item made its appearance in the post-war period and soon became one of considerable importance. If yearly averages are made of the monthly outstanding amounts of this loan as reported in the last of the weekly statements in each month, the following results are obtained:[8]

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[8] *Cf.* J. H. Rogers, *op. cit.*, p. 55.

Year	*Annual average advances to the State by the Bank of France (In billions of francs)*
1913	0
1919	23.4
1920	26.1
1921	25.3
1922	23.0
1923	23.1
1924	22.8
1925	26.5
1926	35.8

The course of these borrowings by the State from the Bank of France followed in a general way the expansions and contractions in the volume of money in circulation, and to a lesser extent the fluctuations in price. The advances increased through 1920, and then diminished during the business depression. They did not resume their upward swing until 1925 and 1926. By their very nature, since the loans were made through the mechanism of bank-note issues, they bore an intimate relation to the quantity of money in circulation. As the following table indicates, the advances from the Bank to the Government constituted from 60 to 70 per cent of the total issue of bank notes:

Year	*Percentage of bank-note circulation made up of advances to the State from the Bank of France*
1919	67
1920	69
1921	68
1922	64
1923	62
1924	57
1925	60
1926	67

The decline in the ratio of advances to circulation from 1921 to 1924 was due to the fact that the Government actually paid back some of these loans. There was, therefore, a general diminution in the State's indebtedness to the Bank, despite the fact that in these years the Government was obliged to ask for new advances from time to time.

Curiously enough, even though these loans were based on bank-note issues and were a very significant factor in the increase in the quantity of money, their partial reimbursement did not result in any corresponding shrinkage in the volume of circulation. The maximum contraction in monetary circulation took place from October 1920 to March 1922 and amounted to 3.8 billion francs, which figure lagged far behind the 5.1 billion francs' shrinkage in the State's indebtedness to the Bank during the same interval. It is very probable, moreover, that there would have been a reduction in circulation even if the State had repaid no loans, simply because 1921 and 1922 were years of business depression, and at such times the quantity of money generally decreases under all circumstances. The causal relationship which one may *a priori* feel inclined to ascribe to reimbursements and contractions in circulation is further attenuated, if not completely destroyed, by the fact that from December 1920 to January 1925, when the item of advances to the State underwent its greatest reduction, falling by 5.4 billion francs, the amount of bank notes in circulation actually increased from 37.4 billions to 40.5 billions.

Other authors have clearly shown the reason for this apparent paradox.[9] The sums repaid to the Bank of France served rather to constitute a source of funds for further subscriptions to government bonds by other banks and individuals than to reduce bank-note circulation. A large part of the reimbursements were thus almost immediately borrowed back by the Government under another form. A comparison between the quantity of bank notes in circulation and the volume of advances from the Bank to the State from year to year shows that when the loans increased in 1919 and 1920 circulation expanded too. The same phenomenon occurred in 1925 and 1926. In the interval the Government found conditions more favorable for obtaining loans by the sale of bonds than through the mechanism of advances from the Bank. As there was really no surcease from borrowing, the monetary circulation never fell to the extent of the repayments to the Bank of France. It was this policy of paying Paul only with money borrowed from Peter which was responsible for the maintenance of a high level of bank-note circulation from 1921 to 1924 when ordinarily a decrease would have been expected.

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[9] *Cf.* J. H. Rogers, *op. cit.*, and Moulton and Lewis, *The French Debt Problem*, pp. 130–137.

It is interesting to consider the effects of these financial tactics on industry. Whether or not it was the conscious aim of the Government, the sustained inflation in monetary circulation probably tended to lighten the burden of French industry in 1921 and 1922 when manufacturers the world over were grievously affected by business depression. It is difficult to prove this, but an increase in the supply of money during a period of crisis may be easily conceived of as having a stimulating effect. It has been observed in many quarters, furthermore, that the business depression in France, which began in the fall of 1920, was less severe than in most other countries. Whatever the effects may have been, the fact remains that the quantity of money in circulation through the whole postwar period was increased and kept large by government borrowings especially from the Bank of France.

Government Bond Issues

As has already been intimated, the quantity of bank notes in circulation was as much affected by the issue of government bonds as by state borrowings from the Bank of France. Outside of France, it was indeed more common for governments to increase their supply of money by asking the public to subscribe to state loans than by arrangements with the bank of issue, whenever, as during the war, they required more funds than taxation could possibly yield. The repercussion of government bond issues on circulation was somewhat as follows.

Government bonds were frequently bought in France not with real savings accumulated through restrictions of expenditure, but with bank loans for which various properties were used as security. It is to be observed that in this sort of transaction few bank notes were withdrawn from circulation and ceded to the Government. Moreover the purchasers of bonds usually turned them directly or indirectly into the bank of issue and received in return fresh bank notes for which the bonds deposited were security. In this roundabout way new monetary issues were made to satisfy the urgent needs of the Government for funds. They were very different from issues of bank notes made in normal times, when discounted commercial paper, generally representing new goods on the market, acted as a counterpart. In final analysis, increases in monetary circulation originating in government bond issues had no counterpart except the State's promise to pay. The normal equilibrium between money and goods was destroyed. Inflation resulted.

The bank-note circulation of France, exclusive of advances from the bank of issue, was approximately twice as great in 1919 as in 1913, and about three times as great in 1925. When in 1926 the borrowings of the State through the sale of bonds were reduced to almost nothing, the ratio remained about the same as in 1925. This enormous increase in circulation, coming from other sources than the Bank of France, was the result of government borrowings at home and abroad. During the war the Government obtained in all, after taking all repayments into account, about 128 billion francs in the form of loans and advances of which 75 per cent were made up of internal loans. About 80 billions of this 97-billion-franc internal loan were state borrowings made otherwise than by advances from the Bank of France. During the post-war period from 1919 to 1925 inclusive, the total net borrowings less repayments of the French State were increased by 159 billion francs, of which 157 billion were internal loans. Of this post-war domestic debt 139 billion francs represent loans other than advances from the bank of issue.[10]

It is impossible to tell how many of the bonds delivered to the public in exchange for funds loaned to the State were used as securities for further issues of bank notes. The only restriction on the amount of new money which the Bank of France could issue as loans on stocks and bonds was that of the legal limit of circulation, which, as a matter of fact, the French Parliament stretched from time to time as emergencies arose. It has been observed, moreover, that the portfolios of the principal banks of France were composed of large quantities of government bonds. Certainly the state loans must have occasioned in this way large increases in note circulation.

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[10] These data are taken from the *Rapport du Comité des Experts* (décret du 31 mai 1926), pp. 148–149. The totals quoted above are the totals of the loans less repayments each year. The bonds and notes issued for the repayment of war damages, including the "paiements en titres d'annuités et obligations" were included in the total of state borrowings. *Cf.* Volume I of this series: Robert M. Haig, *op. cit.*

The advances from the Bank of France to the State, and in a more indirect way the sale of government bonds to the public were as two streams from which flowed torrents of fresh bank notes into the great reservoir of monetary circulation. The following table shows the rise and fall in the level of these streams from year to year:[11]

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[11] The figures from 1919 to 1925 inclusive were taken from the *Rapport du Comité des Experts*, pp. 148–149; the figures for 1926 were communicated by the Bank of France. The domestic loans include bonds issued to facilitate the payment of war damage claims and reconstruction expenses. The loans and advances are net because the reimbursements of bonds falling due and the repayments of advances from the Bank of France were subtracted from the loans contracted each year. Thus the minus sign means that the figures following it represent a net excess of repayments over loans for the year and category considered.

For 1926, the following items were included (in millions of francs) in the loans and repayments:

Loans:

Bons et obligations (net, up to Oct. 1, 1926)	240
Bons ordinaires du Trésor (after Oct. 1, 1926)	123
Dépots de fonds au Trésor	495
Paiements de dommages de guerre	3,663
Bons de la Défense Nationale (Oct. 1–Dec. 31)	2,225
Émission de l'Exploitation Industrielle des Tabacs	3,013
	9,759

Repayments:

Bons du Trésor à 3–6 et 10 ans (2ᵉ série)	3,160
Bons ordinaires du Trésor (Oct. 1 to Dec. 31)	1,068
	4,228

The operations listed from October 1 to December 31 are those of the Caisse d'Amortissement, as is also the loan of the state tobacco monopoly.

Year	*Total net advances to the State from the Bank of France (in billions of francs) during each year*	*Total net domestic loans other than advances from the Bank of France (in billions of francs)*
1919	8.4	31.6
1920	.6	38.4
1921	−2.1	29.7
1922	−.9	20.0
1923	−.6	17.8
1924	−.6	9.0
1925	13.5	−7.6
1926	.4	5.5

In 1925, as is indicated by the minus (−) sign preceding the 7.6 billions of net loans from other sources than the Bank of France, public subscriptions to government bonds were so small as to yield less than the State had to pay back on debentures falling due. Only 4.2 billion francs worth of bonds were sold, while 11.9 billions were redeemed. In order to fill the gap the Government had recourse again to the Bank of France from which it obtained advances amounting to 13.5 billions.

The crisis of 1925 was all the more acute, not only because especially large amounts of loans contracted several years earlier were redeemable that year, but because of the existence of an ominous floating debt, that is to say, of a huge short-term debt, considerable portions of which were constantly falling due from month to month. So long as there was confidence, the public found it to its interest to renew these bonds of one month's to two years' duration every time they expired. When, however, as in 1925 and 1926, for one reason or another, confidence was shaken, and the public feared that the State would shortly find itself unable to redeem these bonds, at least with currency having anything like the purchasing power of the money invested, there was a precipitate rush for repayment, and renewals became increasingly rare.

The credit of the State became more and more shaken and the strain on the government Treasury became increasingly dangerous up to the close of the summer of 1926, when the Coalition Ministry came into power. Then suddenly, as if by magic, there was a return of confidence in government bonds, bringing with it a rapid rise in the value of the franc both in terms of foreign gold currencies and in terms of domestic purchasing power. The point was soon reached in foreign exchange values, at which the Government found it best to stabilize the franc in fact, if not in law, during the first half of 1927.[12]

The general expansion of government loans of the war and the post-war period, accompanied by crises of currency inflation and a declining purchasing power of the franc, did not proceed either quickly or evenly, as the above tables show. Government credit was, in fact, a function of current sentiment with regard to future events; and this sentiment, particularly in the period of post-war readjustment, was constantly changing. There were months when the franc even rose in value, and in these months the statements of the Bank of France revealed that its advances were being paid back and that circulation was diminishing. Thus, on the whole, the movement was irregular. The underlying tendency, however, took the direction leading to the inflation crisis of 1925–1926. Undoubtedly there were a multitude of causal factors, political and psychological as well as economic and financial, but it is clear that the significant rôle was played by government borrowings both from the Bank of France and from the public.

Why the Government Borrowed

A complete discussion of the reasons why the Government resorted to borrowing on so large a scale would lead to incursions into the field of budgetary, taxation and treasury problems.[13] However intricate and complex the *ensemble* of motives may have been, there were a few that stood out with especial force and prominence.

In the first place, it was absolutely necessary for the State to procure funds immediately on the close of hostilities in order to begin and carry on rapidly the reconstruction of the devastated regions in the north and northeast. As it has already been seen, this was where the industrial activity of France had been most concentrated before the war, while the rest of the country was largely agricultural. The great manufacturing agglomerations that lay to the south of the Belgian frontier became fighting zones during the war. Their towering factory chimneys fell to the ground, their machinery was crippled and mangled, their roads were torn up, their workers' homes were razed. As a result, the rate of industrial production was extremely slow in France in 1919, much slower, in fact, than in most belligerent countries, except perhaps Russia. If France hoped to return to her pre-war condition of power, she had to recover her industrial strength, which in modern times determines a nation's status more than anything else. The reconstruction of the ruined industrial territory could, therefore, brook no delay.

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[12] Actual stabilization was legalized in 1928.

[13] For details, see Robert M. Haig, *op. cit.*

The ordinary methods of taxation would never have brought in funds fast enough. The Government had to borrow. From 1919 up to the close of 1925 more than 44 billion francs' worth of bonds were issued specifically for the payment of war damages.[14] This figure does not include loans contracted indirectly for the same purpose. A substantial part of French state borrowings to replenish the Treasury went eventually to defray restoration expenses. It is estimated that by the end of 1926 the Government had paid out a total of nearly 85 billion francs for the repair of war-damaged property.[15]

Except for the 44 billions above mentioned, the great bulk of state loans were issued without any definite mention as to their object. They doubtless helped to pay part of the enormous post-war expenses which, for one reason or another, taxation failed to cover. It is difficult to see how the Government could have avoided resorting to borrowing in the face of the constant demands on the Treasury for military pensions, for the amortization of war indebtedness, for a host of other special disbursements and for normal expenditures which kept on swelling as post-war prices rose.

If the State yielded to the policy of contracting loans beyond the measure of what was absolutely necessary, it was because of the widespread belief that Germany would pay all the extraordinary expenses originating in the war. Victory was followed by a period of intense delirium. The time was not propitious for the cold calculation of Germany's real capacity to pay. These facts are not brought out and insisted upon by way of criticism. On the contrary, the psychological reaction of the French was perfectly understandable. France had suffered and was victorious. It was only natural that the cry should be uttered and repeated endlessly that Germany would be made to pay. At the same time, it must be admitted that this attitude explains, in large part, why France sank so deeply in the slough of debt; and this debt was undoubtedly the basic cause of the financial troubles of post-war France.[16]

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[14] *Rapport du Comité des Experts*, p. 148.

[15] *Projet de Loi présenté à la Chambre des Députés portant fixation du Budget général de l'exercice 1928*, No. 4310, 1er Volume, Annexe XIV, p. 185.

It was thus partly to meet the great imperative expenditures in connection with reconstruction, and partly because of the unreasoned expectation that Germany would pay the French cost of the war that almost unlimited loans were issued, leading to monetary inflation. The result was a post-war record of financial disorder.

Monetary Disorder and Industrial Development

The disturbed and morbid condition of French finance could hardly have avoided affecting the industrial life of the country. Industry and credit, like business and money, are by their very nature so intimately related that it is inconceivable that the productive activity of post-war France should not have reacted profoundly to the vast public credit operations and the violent price fluctuations. Since finance and industry always go hand in hand, calamitous financial events would be expected to have disastrous consequences on industrial development. The fact is, however, that the excessive borrowings by the State, the inadequate and poorly balanced system of taxation, and the greatly disordered currency were not, in France at least, particularly injurious to industry.

Paradoxical as it may seem, the economic events of post-war France lend themselves to interpretation on the basis of a theory that inflation has a stimulating effect on industrial development. It would, however, probably be best to approach the question with the fewest theoretical preconceptions possible. For instance, for a State to borrow, as France did, may violate all sound financial theory, but the expenditure of a great part of this money on rehabilitating industry in the north and on putting in the most highly perfected equipment for production was a good thing. In like manner from the point of view of any theory featuring the interest of bond holders, monetary inflation was certainly a catastrophe. On the other hand there is evidence to show that the increase in the quantity of money in circulation was undoubtedly favorable to manufacturers for at least as long as exporters found their sales stimulated by the depreciation of the currency. Even wage earners benefited from the resulting continuous employment. More or less directly the vicissitudes of French currency powerfully affected industry in all of its ramifications.

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[16] See Volume V of this series: Carlton J. H. Hayes, *National Psychology in Contemporary France* (New York, Columbia University Press, 1929).

CHAPTER IV

CAPITAL

1. The Supply of Capital

Currency and industry are linked together by capital. On the one hand, industry requires capital for its maintenance and growth. On the other hand, while capital is by no means identical with currency, its value is measured in monetary terms, and its acquisition is dependent on the mobilization of savings and other investments through the medium of currency and credit. Ordinarily in modern society fresh pecuniary capital arises from the earnings of industry that are not paid out in dividends and from savings which individuals make from their incomes. To a rather marked degree in France many citizens derive their income from interest on loans to the Government rather than from capital invested in industry. The Government pays this income not from its productive enterprises, such as state railways or telephones, but rather from the proceeds of taxation or of new loan issues. Hence in France the spectacular growth in government borrowings and the concomitant loss in the value of the franc inevitably affected both capital values and sources of new pecuniary capital which are integral parts of modern industrial life.

Government Loans and the Supply of Capital

In view of the fact that currency may be increased by government measures without any counterpart in enhanced industrial activity, new currency does not necessarily call forth new capital. For example, the great expansion in the quantity of money in France during and after the war changed the terms by which capital goods were evaluated rather than their quantity or their value according to any stable standard. Property in post-war France was worth more than ever before, simply because of the augmentation in the number of francs in circulation, which were depreciated francs.

Not only may an increase in currency carry with it no corresponding growth in capital, but it may even be accompanied by a decline in the rate of expansion of capital goods for industry. This is what actually happened when the French government loans, issued at attractive rates of interest, tended to draw off from industry much of the available sources of credit. During the first three years after the war, the Government borrowed annually more than 30 billion francs. In the following three years, however, up to 1925, the public proved to be much less eager to subscribe, and the Government had to resort to borrowing directly from the Bank of France. The exact course of the loans publicly subscribed is difficult to trace because of the fluctuating value of the franc. The following table shows government borrowings from year to year converted from paper francs into francs of 1913 purchasing power, and also into dollars which are tantamount to gold:

NET INTERNAL GOVERNMENT PUBLIC LOANS[1]

(Not including loans from the Bank of France)

Year	*In billions of francs of 1913 purchasing power*	*In billions of dollars (Converted at annual average exchange rates)*
1919	8.87	4.34
1920	7.53	2.65
1921	7.24	1.88
1922	5.33	1.41
1923	3.20	.81
1924	.76	.19
1925	−1.94	−.50

The annual government loans subscribed, thus measured in terms of constant factors, diminished steadily from 1919 right through 1925. This was not due to any contraction in government needs, nor was it wholly due to a vigorous policy of substituting taxes for loans as a source of funds. The Government, on several occasions, offered bonds which the public failed to take. Moreover, in 1924 and 1925 the Bank of France had to be called upon to make large advances to the State. Everything seems to indicate that the Government was meeting with increasing difficulty in obtaining credit. The loss of confidence which became particularly apparent in 1924 and 1925 would explain partially, at least, why the Government repeatedly raised the rate of interest offered. It is difficult to determine, however, whether and to what extent the rising rate of interest was due either to an actual paucity of capital or to the reluctance of capital to take the path of government loans because of the risk involved.

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[1] Source: *Rapport du Comité des Experts*, pp. 148–149. The estimates of internal loans were made up of the following items: Emprunts Perpetuels, Emprunts à terme, Bons et Obligations (net), which include National Defense Bonds, Dépôt de fonds, Emprunt du Crédit National. From this total were deducted internal reimbursements, except those made to the Bank of France. The minus sign indicates an excess of reimbursements.

Government borrowings, as such, would not necessarily be expected to affect the supply of capital, for normally the money borrowed would go back to the public as payment for materials purchased, as salaries, as interest, and as reimbursements of earlier loans. Nevertheless, in post-war France, as the franc declined in purchasing power, the money paid back or expended was not worth as much as at the time it was borrowed, except during 1921 and 1922 when the franc recovered some of its lost value. Thus a person who had purchased 10,000 francs in bonds at 3 per cent before the war received, in 1913, 300 francs as interest. In 1919 his interest payments consisted of the same number of francs, but these 300 francs could buy only what 84 francs might have purchased in 1913; and in 1926 they were worth only 43 francs in terms of their 1913 purchasing power. In like manner private commercial and industrial loans at fixed rates of interest yielded annual payments of which the purchasing power in terms of general commodities, or of gold, or dollars, was constantly shrinking in post-war years. Thus the declining value of the franc tended to dry up at least one stream of new capital, viz., that fed by the payment of interest on securities with fixed rates of return, i.e., bonds. Since the amount of money invested in this way was very large, the whole flow of pecuniary capital, considered not as francs but as purchasing-power units of constant value, must have been

fixed
inc[illegible]
[illegible]

very seriously diminished. On theoretical grounds, therefore, it would seem that an increase in the quantity of money in circulation might operate, under certain circumstances, even to reduce the amount of available capital.

From the point of view of the industrialization of post-war France, the supply of funds to the Government is relevant only in so far as it finds its way eventually to the purchase of productive capital goods. Certain moneys borrowed abroad were used to buy plant equipment and raw materials either in France or elsewhere for French govermental industrial enterprises. Other money loaned to the Government was expended on restoring war-damaged property — a large proportion of which was industrial. Thus government borrowings tended, particularly during the first few years immediately after the war, to stimulate productive activity.

During the early post-war period, which included the years of business depression, 1921 and 1922, savings from the profits of industry were hardly to have been expected. Yet the rising value of the franc helped to improve especially that source of capital which arises from the yield on bonds. Thus, if there was any notable restriction in the supply of capital in post-war France, it must have been from 1922 to 1927.

Private Securities and the Supply of Capital

The statistics of security issues of private corporations, which absorb a very large part of the total investments of the country, reveal the general trend of the capital supply. The issues of new securities were greater in 1920 than in 1919, but then declined during the depression years of 1921 and 1922, especially in the latter year. They rose again during the period of revival in 1923 and 1924, only to fall once more in 1925 to a very low level despite the swelling in circulation and the intense industrial activity. In 1926 they increased again but only slightly. These facts are shown in the following table:

Year	*Stocks and bonds issued by private French companies (In billions of francs)* [2]
1919	3·1
1920	7·9
1921	5·7
1922	3·9
1923	5·0
1924	5·1
1925	3·7
1926	4.8

[2] Source: For the figures of 1919–1921, Jean Vergeot, "Les Émissions," in the *Revue d'Économie Politique*, March–April, 1926, pp. 356–382. The data were taken from the Association Nationale des Porteurs Français de Valeurs Mobilières. For the figures of 1922–1926, *Bulletin de la Statistique Générale de la France*. Both these sources exclude securities issued in cases of absorptions as well as those reserved exclusively to old shareholders.

The above table does not include loans to the Crédit National and the Groupements de Sinistrés (funds for the restoration of war damages), nor railway bond issues, nor foreign security issues on the French market. They are made up without taking into account the "actions d'apport," i.e., shares issued for other than cash payments, and "insertions faites en vue de cotation," i.e., securities which had originally been issued privately and were later announced for public sale on the Bourse. A more complete statement of issues of French securities on the domestic market is given in the following table — but these comprise other than industrial securities:

(In millions of francs)

Years	French Corporations		Crédit National et Groupements de Sinistrés	Railways	Cities and Départements	Long-Term State Loans	Total (Round figures)	Colonial Loans	Treasury and National Defense Bills
	Stocks	Bonds							
1922	1345	2599	10328	2114	175	8188	24700	15	−1300
1923	2325	2678	5694	2193	493	16067	29500	362	−1800
1924	3895	1244	1636	2434	50	4912	14200	86	−1200
1925	2654	1035	.....	1426	570	5934	11600	...	−8700
1926	2884	1883	39	2292	1350	4307	12700	37	1300

Source: *Bulletin de la Statistique Générale de la France*, April–June, 1927, p. 282. The column "Long-Term State Loans" does not include reimbursements of bonds of 2 years or more duration, which were 5,665 millions in 1923, 7,357 millions in 1925, and 3,160 millions in 1926. The minus sign in the last column denotes an excess of reimbursements over loans.

It is obvious that the amount of capital invested, even when measured in terms of paper francs, far from increasing in proportion to the decline in the value of the franc, showed a constant tendency to diminish. In reality, therefore, the decrease from 1920 on was even more important than the above figures indicate. Thus, if the paper francs invested are converted each year into francs of 1913 purchasing power value and into dollars according to the annual average exchange rate, then the following results are obtained:

STOCKS AND BONDS ISSUED BY PRIVATE FRENCH COMPANIES

Year	*In billions of francs of 1913 purchasing power value*	*In billions of dollars (Converted at annual average exchange rate)*
1919	.9	.42
1920	1.6	.55
1921	1.6	.42
1922	1.2	.32
1923	1.2	.30
1924	1.0	.27
1925	.7	.17
1926	.7	.15

In terms of what they could purchase, capital investments in 1926 amounted to little more than 40 per cent of what they had been in 1920. The gold (or dollar) value of these investments in private companies fell to even less than 30 per cent within the same six years. The most critical time of all was 1925, when the decline with respect to the previous year amounted to 30 per cent in terms of purchasing power, and to 35 per cent in terms of gold. In that same year, private companies were laboring under great difficulty in their effort to find capital, and the Government, as has been seen, was practically unable to borrow any money at all, and was, in fact, obliged to reimburse more money than it received as loans. Neither business nor the State was able to find adequate capital.

The "Flight" of Capital

It was during 1924, 1925 and the first half of 1926 that the "flight" of capital and its perils were most vehemently denounced. Undoubtedly during this period the French bought great amounts of foreign moneys and built vast capital reserves in other countries. M. Meynial has estimated that about ten billion francs were exported in 1924, a like sum in 1925, and probably 17 billion in 1926.[3] This massive exportation of monetary capital mirrored, in all probability, rather the widespread fear for the future of the franc at that time, than the desire to escape taxation. On the return of confidence in the latter half of 1926, this capital began to flow back again to France, although the rates of taxation were raised.

The general effect of the flight of capital was to accentuate the fall of the franc. This was only natural in view of the avalanche of francs which overwhelmed the market and sought to be exchanged for more stable moneys. The value of the franc in terms of foreign exchange (or gold) fell, indeed, more precipitately than its value in terms of commodities. Both wholesale and retail prices lagged behind exchange fluctuations, but followed them nevertheless. Such is the opinion of most observers of the movements of exchange and prices in France. When the tide turned in August 1926, and capital began to return, the franc rose in exchange and commodity values almost as quickly as it had fallen.

Post-War Savings as a Source of Capital

The savings accounts in France constitute a very inferior source of funds for investment in industry because of the low maximum limits on individual deposits.[4] Yet official statistics reveal a relatively important number of manufacturers, members of the liberal professions, and landowners among the new depositors. Their withdrawals may represent a flow of pecuniary capital into industry, even if only into small-scale industry, which, it has already been observed, still plays a significant part in the productive life of the nation. Thus the deposits in the state and private savings banks may be considered indicative of savings in general as a source of capital. The importance of this capital supply can be seen from the fact that in 1924 there were, in all, over 16 million bank books in France, representing total deposits of about 12 billion francs.

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[3] P. Meynial, "La Balance des Comptes," *Revue d'Économie Politique*, March–April, 1927, p. 271. M. Meynial's method of computation consists in estimating all the items of the French balance of accounts, and in assuming that the excess on the credit side approximately indicates the export of capital.

[4] The law of October 18, 1919 set a maximum of 5000 francs on individual deposits and 30,000 francs on special public welfare corporation deposits. These limits were raised twice since the war: first by the law of April 24, 1925 to 7,500 francs for individuals, and 40,000 francs for corporations, and again by the law of August 20, 1926 to 12,000 francs for individuals and 50,000 francs for corporations.

During the seven years after the close of hostilities, the total savings deposits of France increased gradually so that at the close of 1926 they were more than twice as great as they had been on December 31, 1919. The year-to-year movement is shown in the following table:

Year	*Total savings deposits in France on December 31st (In billions of francs)* [5]
1913	5.8
1919	7.2
1920	8.1
1921	9.6
1922	10.8
1923	11.6
1924	12.0
1925	13.8
1926	16.0

There was no concomitant progression in investments in securities of private corporations, for these even diminished after 1920. It is particularly interesting to observe that while the purchase of stocks and bonds declined very notably in 1925 and 1926, savings were increasing rapidly. This is probably attributable to the fact that in times of great uncertainty, such as periods of acute inflation, people find it to their interest to keep their funds fluid. Business men, who in the year 1913 made up only 5 per cent of the number of new depositors of the State Savings Bank, constituted more than 16 per cent of those opening new accounts in 1925. Such was the rush of possessors of liquid assets to put their money in safe custody, yielding some interest, and yet always available in case of need or of a monetary catastrophe.

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[5] Source: The data for the years 1925 and 1926 were taken from Jean Vergeot, "Les Caisses d'Épargne," in the *Revue d'Économie Politique*, March–April, 1927, p. 439. For the previous years the data were taken from the *Annuaire Statistique*.

In the case of savings, as in that of investments in securities, it is difficult to interpret amounts given in terms of post-war paper francs, because of the relentless fluctuation in the value of the monetary unit. The real importance of investments, it was seen, could best be determined by reducing the paper francs to francs of 1913 wholesale purchasing power. Since the wholesale price index is based largely on the cost of machinery and of raw materials eventually purchased by the invested money, the amount of paper franc investments deflated in this way indicates, if only roughly, what these investments meant to business and industry. Small savings, however, measured in paper francs, must be reduced in another way to terms of constant significance, for they represent, above all, forbearance from consumption on the part of individuals. It is not, therefore, the wholesale price index, but the index of the cost of living which forms the more suitable denominator for converting post-war annual paper franc savings to savings of uniform value.

When thus measured in terms of the cost of living, total savings deposits reveal no particular tendency to decline during the post-war period. In view of the fact, however, that the franc fell lower on the foreign exchange market than on the market where articles of ordinary consumption are bought, the dollar (or gold) value of savings deposits did shrink, especially in the latter post-war years. Although in 1926 the total savings amounted to 16 billion paper francs as compared with 5.8 billion francs in 1913, nevertheless on the basis of what paper francs could buy to sustain a family of four, these 16 billions were worth only 48 per cent of the 5.8 billion pre-war francs, and on the basis of the weight of gold or number of dollars they could purchase they were worth about 46 per cent of the 5.8 billion. It is also interesting to note in the following table that both in terms of real abstinence from consumption and in terms of dollars, there was a very perceptible increase in savings during the years of business depression, 1920 and 1921:

TOTAL SAVINGS DEPOSITS IN FRANCE

Year	*Reduced on the basis of 1913 cost of living index*[6] *(In billions)*	*Converted into dollars*[7] *(In billions)*
December 31, 1913	5.8	1.12
" 1920	2.2	.48
" 1921	3.2	.73
" 1922	3.5	.78
" 1923	3.4	.61
" 1924	3.1	.65
" 1925	3.2	.65
" 1926	2.8	.51

Bank Deposits as a Source of Capital

Bank deposits and current accounts furnish another index regarding the condition of capital in France. The total bank deposits of the country are not known, but those of the four principal credit banks[8] and their numerous branches are published and may be taken as representative of the general trend. It is to be observed, however, that it is difficult to compare post-war deposits with those of 1913 on account of the growth of Treasury deposits after the war and because of the introduction of National Defense paper (*Bons de la Défense Nationale*). So many new factors entered from time to time into the French credit situation during the years of inflation and of vast government borrowings that comparisons not only with pre-war figures, but even between figures of different post-war years, are very complicated and hazardous. Furthermore, from the point of view of industrial capital the amount of bank deposits has but a limited significance, because it is not the policy of discount banks to lend money for more than a few months at a time. These funds are, therefore, a source rather of current circulation capital for wages, raw materials, rapid turnover transactions, etc., than of fixed capital, such as is invested for a long time in machinery, buildings and the like, which are the very foundation of industrial development.

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[6] Computed by dividing the amount of deposits in paper francs by the index of the cost of living of the last quarter of each year (combined index for Paris, Lyons, Dijon, Grenoble, Bordeaux and Rouen) and multiplying the result by 100. See Appendix A, p. 585.

[7] Computed on the basis of the average exchange rate for the month of December of each year.

[8] These four banks are the Crédit Lyonnais, the Comptoir d'Escompte, the Société Générale, and the Crédit Industriel et Commercial.

The course of deposits of the four principal credit banks is seen in the following column of figures:

Year	*Deposits and current accounts of the four principal credit banks (In billions of francs)* [9]
December 31, 1913	5.7
" 1919	12.3
" 1920	13.5
" 1921	13.6
" 1922	14.2
" 1923	15.2
" 1924	14.9
" 1925	19.9
" 1926	22.5

From 1919 to 1920 there was a perceptible increase, which was not at all proportionate with the rise in prices at that time. Deposits continued swelling during 1921 and 1922, years which embraced the cycle of declining prices, business depression and recovery. This is contrary to the usual experience in periods of business and industrial inactivity, when less commercial paper is discounted, and consequently fewer deposits are created. It is interesting to note, moreover, that deposits increased only slightly in 1923 over 1922, and even fell in 1924 with respect to 1923. And all this when prices were steadily rising! Then, from 1924 to 1925 deposits bounded upward sharply, by about a third (in fact, more than prices rose in the interval), but not to the extent that the franc fell in terms of dollars. The most notable expansion in deposits took place in the year of greatest inflation, and was probably due to the prevalent policy of keeping capital liquid in times of impending danger. This tendency is observed in the spring of 1926, which was characterized by acute monetary inflation, when deposits and current accounts increased by about 17 per cent from the first of the year up to the end of July. There was, then, plenty of money available for short-term loans, but very little for long-term loans. Deposits and current accounts, which are forms of short-term loans, naturally tended to increase, while investments in stocks and bonds diminished.

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[9] Source: Jean Loriot, "Les Banques," in *Revue d'Économie Politique*, March-April numbers for the years 1923–1927. On the last day of July 1926 these deposits and current accounts reached their peak with 23.3 billion francs.

In terms of constant purchasing power, and in terms of gold, bank deposits and current accounts fluctuated from year to year as follows:

DEPOSITS AND CURRENT ACCOUNTS OF THE FOUR PRINCIPAL CREDIT BANKS

Year	*In billions of francs of 1913 purchasing power*	*Converted into billions of dollars*
December 31, 1913	5.7	1.1
" 1919	3.5	1.7
" 1920	2.7	.9
" 1921	3.9	1.0
" 1922	4.3	1.2
" 1923	3.6	.9
" 1924	3.1	.8
" 1925	3.6	.9
" 1926	3.2	.7

These deposits were thus at the close of 1926 about 44 per cent lower in wholesale purchasing power, and more than 36 per cent lower in their capacity to buy dollars or gold than they had been on December 31, 1913. In so far as the four principal credit banks are concerned, their funds available for short-term capital investments were certainly diminished after the war.

2. The Demand for Capital

The Rising Rate of Interest

If other evidence were lacking, the constant rise in interest rates which manufacturers had to pay in order to borrow money would be proof positive of a scarcity of capital in post-war France. It has already been pointed out that the fact that the Government was forced to augment the interest offered on its public loan issues might be indicative rather of a presumed greater risk in lending money to the State than of a shortage of available money. The prospective investor was haunted by the prevalent fear that with the continued depreciation of currency the value of government bonds might diminish in the future as it had diminished since the war. When, however, private industry as well is found to have constantly increased the interest rates on its bond issues, then it is clear that there must have been a drying up of the sources of investment capital in France.

The following figures show the annual average rate of interest on investments in bonds issued by private corporations from 1922 on:

Year	*Rates of yield on private corporation bond issues*[10]
1922	6.14 (discount at issue not included)
1923	6.33 " " " " "
1924	6.77 " " " " "
1925	8.55 (discount at issue included)
1926	9.45 " " " "

The rise was continuous and important. The above rates were computed from the return on the price of issue, and are net of all taxation except the tax on transfers. For the first three years no consideration was taken of the discount at the time of issue, because maturity was generally very distant and the imputed additional return per annum was consequently small. When, however, from 1925 on, the bonds could find subscribers only if issued for relatively short periods, then the annual rate of return on such investments was appreciably increased by the discount because of nearness of the date of redemption at par. For example, in 1925 the return, not including the discount, was 7.67 per cent, and with the discount was 8.55 per cent.

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[10] *Bulletin de la Statistique Générale de la France*, April, 1926, p. 283, and April–June, 1927, p. 280.

Another manifestation of the increasing cost of borrowing is found in the fluctuation of the price of bonds bearing a fixed rate of interest. The rate of yield in this case is not based on the price of issue, but on the current purchase price of bonds already issued. In other words, the figures given in the table below represent the net rate of capitalization, including the discount, prevalent on the Bourse from time to time:

Date	*Current market rate of capitalization on bonds* [11]
1913	3.8
March, 1919	5.1
April, 1920	5.8
September, 1920	6.1
July, 1921	6.2
August, 1922	5.5
September, 1923	6.0
August, 1924	6.7
February, 1925	8.9
November, 1925	10.0
March, 1926	8.9
July, 1926	9.5
November, 1926	8.1
April, 1927	6.2

The bonds for which the above rates of capitalization were computed were not only industrials, but state and real-estate bonds as well.[12] It is interesting to observe that the net rate of capitali-

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[11] Source: *Bulletin de la Statistique Générale de la France,* April, 1926, p. 287, and July–September, 1927, p. 401.

[12] The following were the bonds the quotation of which entered into determining the above rates of capitalization:

1. Rente Française	3 per cent
2. Chemin de Fer	3 per cent
3. Foncière 1883	3 per cent

zation was declining from July to November 1926, when the policy of deflation was adopted, and that it had fallen to about 6 per cent by April 1927.

The Fluidity of Capital

The scarcity of capital was aggravated in the later years of inflation by the reluctance on the part of investors to buy any long-term securities. In a period of depreciating currency, capitalists naturally tried to avoid long-term immobilizations during which falling exchange rates and rising prices might rob bonds of all but a semblance of their former value. In 1925, when the amount of money in circulation was swelling rapidly, 70 per cent of the industrial bonds issued were in the category to mature in 5 to 10 years. In 1926, during the latter half of which there was a return of confidence and a cessation of monetary inflation, the bonds to run from 5 to 10 years made up only 27 per cent of the total issued, and those of over 10 years' duration constituted 69 per cent.[13]

The increase in savings accounts and in the deposits of the principal credit banks is, as it was noted, also indicative of the general tendency to keep capital liquid in the post-war period. The banks themselves adopted the same policy, for their cash on hand nearly doubled from January 1924 to December 1925, while their loans on securities and *reports* (Bourse loans) remained practically stationary (increasing only by 4 per cent in this interval). The ratio of cash on hand to deposits was 9 per cent in January 1924 and reached its maximum in November 1925 with 17 per cent.

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4. Obligations Industrielles.... 3 per cent
5. Obligations Industrielles.... 4 per cent
6. Rentes 1917.............. 4 per cent
7. Rentes 1915–1916......... 5 per cent
8. Chemin de Fer............ 4 per cent
9. Chemin de Fer............ 5 per cent
10. Foncière 1913............. 4 per cent
11. Obligations Industrielles.... 5 per cent
12. Obligations Industrielles.... 6 per cent

[13] *Bulletin de la Statistique Générale de la France*, April, 1926, p. 283; and April–June, 1927, p. 279.

Throughout 1926 the banks continued to keep large sums in ready cash, so that at the end of that year the proportion was still 16 per cent.[14]

Shrinking Capital Values

The depreciating currency, the diminishing flow of new capital, and the increasing interest rates were not without profound effects on capital values. Investments in pre-war bonds bearing a fixed rate of interest suffered most, and their fall in value was even greater than the decline in the value of the franc. The following column of figures shows the fluctuation in value of typical pre-war bonds in terms of paper francs:

Year	*Index of the value of French bonds (In terms of paper francs)* [15]
1913	100
1919	83
1920	74
1921	72
1922	77
1923	75
1924	67
1925	58
1926	60

In reality the value of these bonds shrank much more than is indicated above, for if in 1926 they were worth 60 per cent of the number of francs they had been worth in 1913, it must be remembered that the 1926 franc had fallen to one-seventh of its pre-war value with respect to wholesale commodities. Actually, therefore, in terms of their wholesale purchasing power, these bonds had really lost over nine-tenths of their value. The rapidity of the shrinkage in purchasing power thus calculated is seen as follows:

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[14] J. Loriot, *op. cit.*

[15] *Bulletin de la Statistique Générale de la France*, July-September, 1927, p. 395. These indices were computed by taking five groups of pre-war securities bearing a fixed rate of interest.

Year	*Index of the value of French bonds in terms of francs of 1913 purchasing power*
1913	100
1919	23
1920	15
1921	21
1922	24
1923	18
1924	14
1925	11
1926	9

This precipitous decline in capital values, affecting in particular fixed-interest securities, was very disastrous to private fortunes. It has been estimated that an individual's pre-war capital, amounting to 110,995 gold francs, and invested at that time on a typically conservative basis — 60 per cent in bonds of which a third were foreign, 30 per cent in high grade stocks, and 10 per cent in speculative stocks — would be worth by the end of December 1926 as much as 183,056 paper francs, but only 36,611 gold francs.[16] In gold (or dollars), this fortune fell to less than a third of its pre-war value. The weakest link in this chain of investments was that made up of pre-war French bonds evaluated in 1913 at 43,257 gold francs. Thirteen years later they were worth less even in terms of paper francs, being quoted at 27,310 francs at the close of December 1926. In their gold (or dollar) value, they had naturally fallen even more — to 5,462 gold francs, representing but an eighth of their pre-war value. In other words, these bonds shrank even more than the franc itself, for the latter was worth more than a fifth of its 1913 gold value in December 1926. The interest on these bonds, being paid as an unvarying sum of francs from year to year, diminished in gold value only as the franc diminished, that is to say, less than the market price of the bonds themselves. This is only another manifestation of the rise in the rate of interest as capital became scarce.

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[16] Marcel Bourbeau, "La Bourse des Valeurs," *Revue d'Économie Politique*, March–April, 1927, p. 212. A similar estimate was made by the French Committee of Experts (*Rapport du Comité des Experts*, p. 67) who constructed a typical pre-war investment table for a fortune of 200,000 francs. By June 30, 1926, the securities which were exclusively French were quoted at 149,060 paper francs of which the gold equivalent was 21,295 francs. Thus in 13 years this fortune had lost 89 per cent of its gold value.

Foreign bonds, too, declined in value after the war in terms of a stable standard. In the typical fortune just examined, these bonds were worth before the war 16,181 gold francs, and at the end of December, 1926, 50,114 paper francs, of which the gold equivalent was no more than 10,023 francs. Even this group of bonds, therefore, lost about 37 per cent of its pre-war gold value. To be sure the return in paper francs on bonds of countries with a gold currency was very high in 1925 and 1926, but this did not prevent their gold value from contracting, if only slightly, because in a period of rising interest rates the current rate of capitalizing returns increases.

The economic and social consequences of this general post-war collapse in the value of bonds were very marked. The extent of the ruin to private fortunes can be inferred from the fact that 69 per cent of all the securities quoted in the Paris Bourse on December 31, 1913, were debentures bearing a fixed rate of interest.[17] Not only were the numerous individual bondholders affected, but the whole nation was impoverished by the resulting contraction in the supply of monetary capital. As a consequence of the diminution in the gold values and in the purchasing power of the yield on bonds, capitalists had fewer fresh funds to invest. And what is more important, the reduction in the capital value of bonds sheared them of much of their power as securities for raising other capital for investment.

Not all of this loss to bondholders represented a complete evaporation of capital. Often it was merely indicative of a transfer of wealth. What lenders lost was at least partly compensated by gains to borrowers. The State, for example, which had borrowed gold before the war was paying interest and redeeming bonds in depreciated currency. This profited the State in so far as the

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[17] Hervé de la Fontaine de Follin, *Les Transformations du Marché des Capitaux en France depuis 1914* (Paris, 1925), p. 12.

Government invested the capital thus gained, or transferred it to others for investment. Industrial firms and other private corporations, which had issued debentures before the war, also found the situation to their advantage. In view of the fact that they too were paying interest and reimbursing loans at maturity in paper francs, when they had borrowed gold, the difference in value served to increase profits, to expand plant equipment, to issue dividend shares, or to stave off bankruptcy. To a lesser extent this was true of bonds subscribed to after the war, because they also gradually contracted more or less in gold and purchasing power value as the franc depreciated.

Stocks did not suffer so great a decline in value as did bonds. In terms of gold or dollars, however, they were, as a general rule, worth much less in 1926 than in 1913. The domestic stocks in the typical pre-war fortune considered above amounted in December 1926 to a little more than one and a half times their 1913 price in terms of paper francs.[18] In terms of gold, they had fallen in that interval to less than a third of their pre-war value. At the same time, the foreign stocks in this fortune — representing four outside corporations — had increased in price about threefold in terms of paper francs, and had fallen by only 41 per cent in terms of gold. These results are not conclusive because they are based on rather small samples — consisting of only eight different domestic stocks, three of which were quoted in 1926 in depreciated francs at less than their 1913 price.

Fluctuations in the value of stocks over a long period of time cannot be taken as a reliable index of movements in the supply of capital. The prices of stocks often rise and fall for reasons entirely independent of the total amount of money seeking investment. Such factors as changing competitive conditions in business or the rapid expansion of certain groups of enterprises, like those of the growing electrical, chemical and automobile industries, exercise a very great influence on the earnings of private corporations, and consequently on the price of their stocks. Nevertheless a general notion of the post-war fate of capital in the form of stocks can be gathered from the index of stock values constructed by the *Statis-*

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[18] Marcel Bourbeau, *op. cit.*

tique Générale de la France on the basis of 184 different shares.[19] As the following table shows, the 1926 value of stocks in paper francs rose to only two and a third times their gold value in 1913:

Year	*Index of the price of stocks in depreciated francs*
1913	100
1919	123
1920	151
1921	113
1922	119
1923	172
1924	208
1925	200
1926	233

If the basis of comparison is shifted from 1913 to 1919, it is seen that the post-war fluctuations in the price of stocks at no time deviated very far from the general trend of wholesale prices:

Year	*Index of the price of stocks*	*Index of wholesale prices*
1919	100	100
1920	123	143
1921	92	97
1922	97	92
1923	140	118
1924	169	137
1925	163	154
1926	190	197

Moreover the net earnings on stocks also kept pace with the wholesale price movement:

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[19] *Bulletin de la Statistique Générale de la France*, July–September, 1927, pp. 390–405.

Date	*Index of yield on stocks*[20]
May 1919	100
November 1920	118
December 1922	122
September 1923	143
August 1924	169
February 1925	174
March 1926	193

It is obvious that in the general compression of capital values after the war stocks fared much better than bonds. That explains why the French investor departed from the time-honored tradition of favoring bonds and turned with avidity to stocks whose value and dividend did not crumble with each quake in the monetary situation. Private corporations seeking new capital in the post-war period had to adapt themselves to this changed situation. As the following figures indicate they issued stocks rather than bonds, particularly in the more critical years:

Year	*Ratio of stock issues to bond issues*
1907–1913 (average)	1.31
1919	1.30
1920	1.34
1921	1.09
1922	.80
1923	1.38
1924	4.10
1925	3.56
1926	2.22

The shrivelled state of French capital after the war was one of the subjects of inquiry of the French Committee of Experts appointed on May 31, 1926. They found, for example, that the total inherited fortune of France subject to death duties was 5.5 billion francs in 1913 and 9.6 billion in 1924.[21] Even if allowance be made for the fact that there was more transmission of patrimony before death in the post-war period than in 1913 because of the higher inheritance taxes, it is clear that the rise in the paper value of francs of this aggregate of French wealth was not at all in proportion with the rise in prices nor with the fall in the gold value of the franc. The Committee of Experts ascribed this diminution partly to the cession of many foreign securities to the State during the war in order to bolster up public credit at that time, and to the disaster which befell certain foreign government bonds like those of Russia, Austria, etc. Furthermore, as has just been seen, French bonds suffered enormous depreciation. Inheritances, however, were made up not only of securities but of other forms of property which must have declined in value too. Real estate in urban communities did not follow the general price movement because of the post-war legal restrictions on rent. Rural property only doubled from 1913 to 1924, when wholesale prices practically quintupled. A very important causal factor determining this contraction in value was the prevailing high rate of interest after the war, which meant that properties were then evaluated on the basis of a higher rate of capitalization than in 1913.

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[20] *Bulletin de la Statistique Générale de la France*, April, 1926, p. 287. The base was shifted from 1913 to 1919 by dividing the index numbers of the *Statistique Générale de la France* by the index number for May, 1919.

[21] *Rapport du Comité des Experts*, pp. 72–73.

Summary

The general contraction in capital values obviously resulted in an important decrease in the quantity of pecuniary capital available to industry. War-time destruction of property was perhaps the underlying cause. Even the losses in value immediately ascribable to inflation may be traced back, to a large extent, to ruined factories and devastated lands, the restoration of which necessitated much government borrowing and a great expansion in monetary circulation. In the first years after the war there was an abundance of liquid capital which flowed into the coffers of the State and of private industry, and was used to repair war damages and modernize plant equipment. As time wore on, and the radiant optimism of the early post-war years gave way to a cold appreciation of unattractive realities, the Government found it more and more difficult to borrow money, and the total private issues of securities fluctuated from 1922 to 1926 between four and five billion paper francs — diminishing, therefore, in terms of any constant standard of value.[22] In the meantime savings accounts and credit bank deposits moved upward with relation to investments. In 1925 something like a crisis developed for capital. During 1924, 1925 and 1926, it is estimated that 37 billion francs left France for lands where capital was presumably safer. The capital that remained tended, as far as possible, to stay liquid, and very rarely indeed took the path of long-term investments.

As the crisis became more acute, the current rates of interest increased. Industry had, therefore, to pay a high price for whatever capital it could borrow. The only forms of security issues which found any favor with investors were stocks, because, unlike bonds, their value and yield tended to fluctuate more or less in the direction of changes in price. Nevertheless, the supply of capital that went into industry even in this way, when measured in terms of gold, was diminishing rapidly.

In terms of depreciated francs the value of most land, buildings, and capital goods, as well as of securities, rose, but it did not rise as much as the general level of wholesale prices. Hence, not only in terms of gold but in terms of purchasing power too, there was a shrinkage in capital values. This was frequently due to high interest rates, of which the inevitable counterpart is a high rate of capitalization.

The effects of this contraction in capital values on the mechanism of industrial production were varied and often contradictory. There was certainly no physical change in mines, forests, fields, buildings and plant equipment at all comparable with the depression in their value. It is to be noted that since different types of securities and of property in general were unequally affected by the general slump in prices, each industrial enterprise profited or lost, depending upon its particular relation to one form of wealth or another. Firms with large bond issues dating from the pre-inflation period, for example, found their interest item in the cost of production assuming ever smaller proportions, and thus benefited by the situation. On the other hand, industrial enterprises in need of new capital at the time of inflation suffered severely because of the scarcity of money seeking long-term investment and because of the high cost of borrowing. Still the decline in values probably affected industrial property and industrial yields less adversely than any other forms of wealth and income.

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[22] *Bulletin de la Statistique Générale de la France*, April–June, 1926, p. 276.

CHAPTER V

POST-WAR PRODUCTION

At the close of hostilities industrial production in France was at a very low ebb. This was to have been expected. The principal plant equipment of the country, situated in the devastated north, had been either damaged or destroyed. National market conditions were in a state of chaos, owing largely to rapid adjustments made necessary by the advent of industrial Alsace-Lorraine into the body politic of France. Currency was unstable; labor unsettled. And France was rudely tossed on the sea of economic disorder which shook Europe immediately after the war.

Just how the productivity of French industry had fallen in 1919 is seen in the following table. These percentages, calculated by M. Dessirier, indicate the ratio of production in different industries in 1919 as compared with production in the same industries in 1913. For both years Alsace-Lorraine is included as part of France, but the work of post-war reconstruction in the north is omitted because it is not part of the normal industrial activity of the country, and because there is nothing to compare it with before the war.

Industry	*Ratio of production in 1919 to that of 1913 in France and Alsace-Lorraine*[1]
Extraction of Coal	50%
" " Iron Ore	22
" " Other Metallic Ores	29
Consumption of Raw Cotton	49
" " Raw Wool	48
Silk Conditioned	94
Production of Pig Iron	26
" " Steel	31

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[1] Source: J. Dessirier, "Indices mensuels de la Production industrielle en France," *Bulletin de la Statistique Générale de la France*, October, 1924, pp. 73–109, April, 1926, pp. 297–332. See below, footnote 6.

Industry	*Ratio of production in 1919 to that of 1913 in France and Alsace-Lorraine*
Iron and Steel Manufactures (including Automobiles)	57%
Consumption of Copper	69
Shipbuilding	36
Building Trades	19
Leather	118
Paper	52
Rubber	305

It is seen that the metallurgical industries were the most seriously affected, for the amount of pig iron and steel produced in 1919 was only 29 per cent of the amount turned out in 1913. The extractive industries were somewhat better off, for their productive yield in 1919 was 44 per cent of that of 1913. The output of manufactured metal products in the year after the war was a little more than half (54 per cent) of the 1913 output. As for the textile industries, their manufactures in 1919 amounted to about 60 per cent of their 1913 production. By weighting all these percentages on the basis of the number of gainfully occupied persons in each industry and then obtaining an average, M. Dessirier computed a composite index number of production for all industries in France, which was 60 in 1919 as compared with 100 for 1913.

It has already been observed that this difference of 40 per cent indicates only part of the general loss in industrial productivity which France suffered immediately after the war.[2] No account is taken in that figure of the very probable increase in the rate of production which might have taken place from 1913 to 1919, had it not been for the war. In this epoch of rapid progress in manufacturing technique, it would be hardly too much to suppose that the trend of expanding industrial output from 1907 to 1913 might have continued from 1913 to 1919, if four years of destructive warfare had not intervened. On the basis of such an assumption, the real measure of regression in French manufactures in 1919 was much nearer 54 per cent than 40 per cent.

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[2] Chapter I, p. 22.

Agriculture too showed a tremendous falling off in the year following the war. The 1919 yield for all agricultural products was but 70 per cent of the average annual yield from 1909 to 1913 (Alsace-Lorraine included).[3] The diminution was not so great as in industry, because the tillage of the soil was more evenly spread over the territory of France, and so a smaller proportion of the productive forces of agriculture in the country was affected by the devastation in the north. Moreover, in view of the practically stationary condition of pre-war French agricultural production, it is hardly likely that there would have been an increased yield even if the war had not occurred.

The status of French farm production immediately after the war as compared with pre-war production is shown in the following table:

Crop	*Ratio of agricultural production in 1919 to the average annual production of 1909–1913 in France and Alsace-Lorraine*[4]
Wheat	57%
All Cereals	54
Beans and Peas	67
Potatoes	59
Forage Crop	55
Crops from Permanent Meadows	79
Sugar Beets	22
Wine	118
Live-stock	
Number of Horses	76
" " Cattle	85
" " Sheep	54

Each separate crop was differently affected by the changed conditions at the close of hostilities. Cereals, potatoes, peas, beans and the forage crops which require a great deal of labor and a considerable amount of fertilizer were quite short in 1919 of their pre-war quantity. Hay, on the other hand, which needs only cutting in permanent meadows, was almost as plentiful immediately after as before the war. Sugar beet production, being concentrated in the north, where destruction was most intense, was reduced in 1919 to about a fifth of its pre-war measure. Since the vineyards of France practically never reach as far north as the battlefields of the Great War, they were untouched and their yield in wine in 1919 was even richer than the pre-war normal output.

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[3] See below, p. 105.

[4] The computation of these percentages is described in Chapter XVI.

While in France both industry and agriculture emerged from the war with their productive forces seriously impaired, there were other nations which suffered even more. Russia, for example, was completely exhausted by years of intensive warfare and revolution, for her economic structure, which was very weak even before the war, was violently shattered by successive shocks. The various component parts of the old Austro-Hungarian Empire — particularly Austria — also fared very badly when the economic unity of that vast territory was destroyed. It is probably true that Eastern and Central Europe were in a worse plight in 1919 than the more highly organized countries of Western Europe. In this latter group France was perhaps the greatest sufferer. Of all the belligerent nations the United States came out of the war least affected, and in fact had a greater productive capacity in 1919 than in 1913. Even the neutral nations of Europe were not so fortunate.

The figures which follow reveal how badly stricken France was in comparison with her neighbors from the point of view of production. There were, no doubt, special circumstances which determined the fluctuations from 1913 to 1919 in the case of each country and each product. For instance, Germany was obliged to speed up her coal production in 1919 in order to make reparation deliveries to the Allies. Belgium, because of enemy occupation, was slow to reorganize her industries. Whatever the particular conditions may have been affecting the different countries in their productive capacities, it is clear that in France industry and agriculture were more severely crippled than in the adjacent countries to the north, south and west.

PERCENTAGE RATIO OF PRODUCTION IN 1919 TO PRODUCTION IN 1913[5]

Country	Coal	Pig Iron	Steel	Wheat	Potatoes
France	50	26	31	57	59
Germany	85	43	46	...	..
Great Britain	80	72	99	123	92
Belgium	..	10	14	73	88
Italy	..	...	74	79	78
United States	97	100	111	127	98

1. Post-War Progress in Industry

The index numbers computed by M. Dessirier, referred to above, make it possible to trace the course of French industrial and mineral output monthly as well as annually for the post-war years. The accompanying chart (Chart II), which is based on the Dessirier composite index numbers, indicates the general trend of industrial and mineral production.[6] It shows a rather halting development during 1919 and 1920, even though these were prosperous business years for France. This is perhaps due to the fact that the reconstruction work in the north was not included in these index numbers and that the rest of the productive activity of the country was still hampered by damaged plant equipment and other changing circumstances. The year 1921 was a bad one, registering, as it did, for the first nine months a very acute decline in production. Toward the close of that year there began a remarkable recovery which continued its upward movement until the autumn of 1926. There was, however, a temporary reaction in the first half of 1923, when the Ruhr was occupied by French troops; and again a retardation may be noted in the early part of 1924 when the franc fell precip-

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[5] *Monthly Bulletin of Statistics*, *The International Year Book*, *The Memorandum on the Steel and Iron Industries*, and *The Memorandum on the Coal Industry*, all published by the League of Nations; and the *Annuaire Statistique de la France*. The German percentages were computed by comparing the German post-war production within the new boundaries with pre-war production for the same area. Lignite was included in coal, a ton of lignite being taken as equivalent to .2222 tons of coal.

[6] For an explanation of the Dessirier composite index numbers, see Appendix B, p. 586.

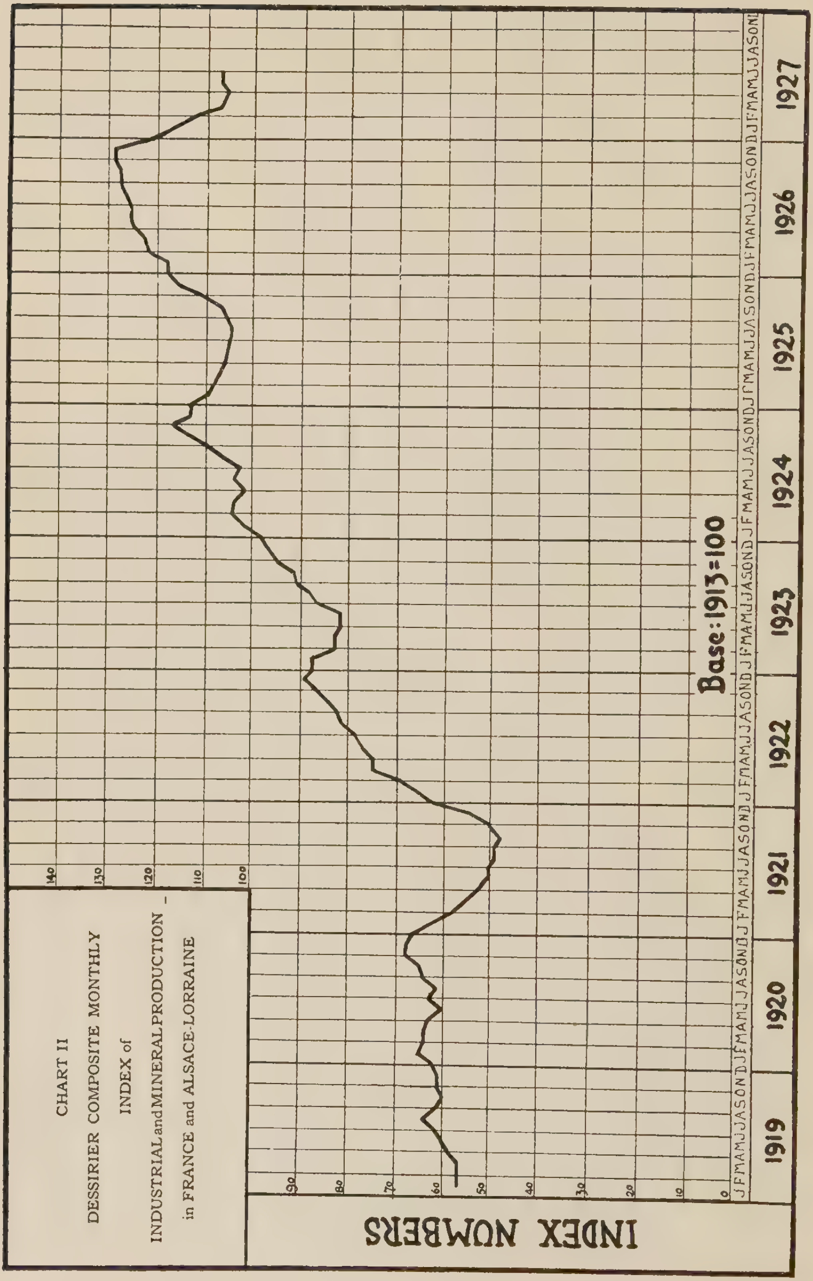

CHART II

DESSIRIER COMPOSITE MONTHLY INDEX of INDUSTRIAL and MINERAL PRODUCTION in FRANCE and ALSACE-LORRAINE itately in exchange value for a short time. In the last months of 1924 and through the first half of 1925 there was a decided drop, which repeated itself when deflation and *de facto* stabilization set in toward the close of 1926 and in the early months of 1927. On the whole, the curve is one with a very marked rising trend from 1921 to the autumn of 1926, with only three recessions of any importance, and these were neither of great extent nor of long duration.

There is something astounding in the suddenness with which this curve starts steeply on its upward path from the close of 1921 on, after three years of apparent stagnation and decline. This is probably due more to the nature of the data entering into the Dessirier composite index numbers than to any brusque change in the actual scheme of production. M. Dessirier omitted from his computations, for very sound reasons as it was seen, the building activity connected with the reconstruction work in northern France. At the same time, he could not fail to include that sudden swelling in industrial output which took place once the damaged and destroyed factories in the north were restored. With the completion of the task of reconstruction, there was at first only a shift in the direction of productive activity, rather than a very abrupt increase. This by no means takes away from the accuracy of the curve, but, on the contrary, emphasizes its character as a record of real post-war industrial progress.

The next chart (Chart III), based on the Dessirier combined index numbers, shows the month-to-month fluctuation in production in the extractive, metallurgical, textile and machine trades industries.[7] The movement of the separate curves both before and immediately after the depression of 1921 took the same general direction. Then, from 1924 on, they diverged from each other. The early progress in the textile industries was not sustained, and the rate of increase in metallurgical production diminished. The greatest expansion took place in the metal trades, but that was very erratic.

The annual composite post-war index numbers of production are shown on page 101.

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[7] For the movement in production in the component branches of industry entering into these groups, see chart on p. 159.

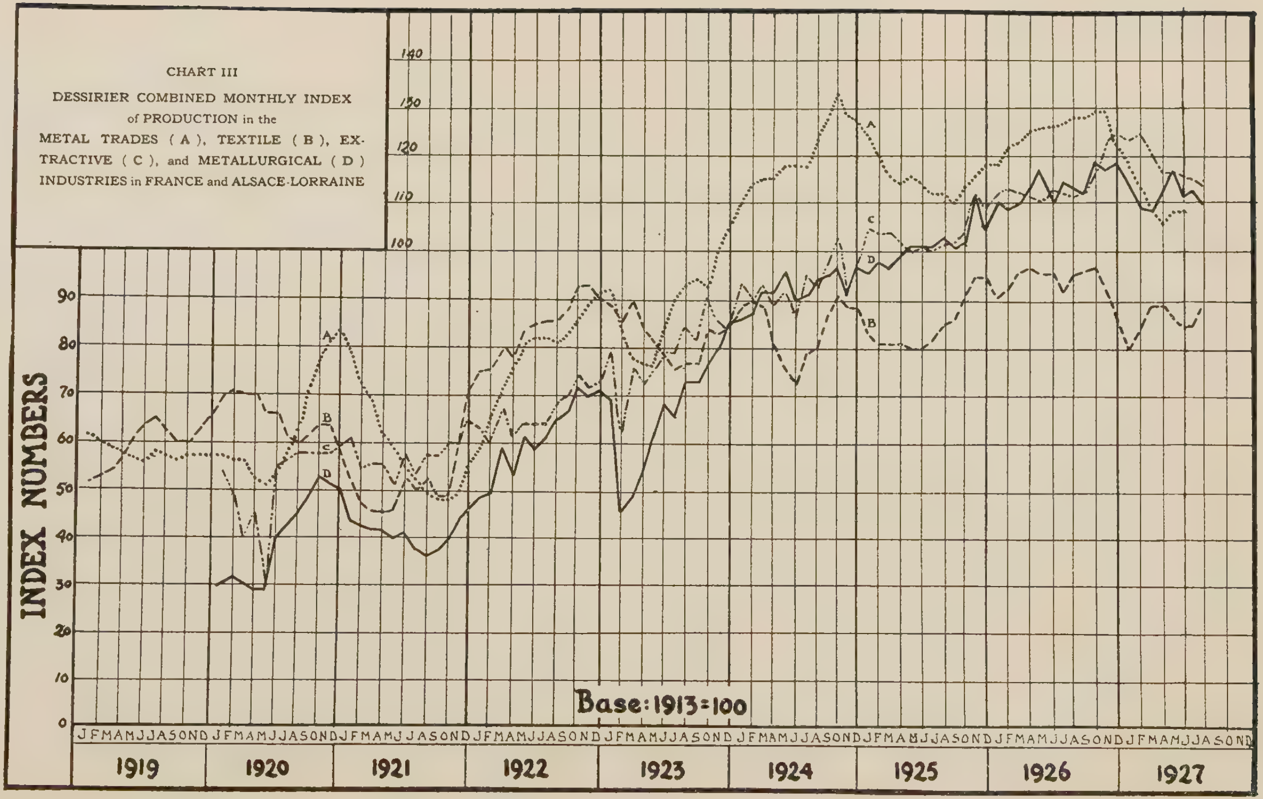

CHART III

DESSIRIER COMBINED MONTHLY INDEX of PRODUCTION in the METAL TRADES (A), TEXTILE (B), EXTRACTIVE (C), and METALLURGICAL (D) INDUSTRIES in FRANCE and ALSACE-LORRAINE

Year	*Composite index numbers of industrial and mineral production in France and Alsace-Lorraine*
1913	100
1919	60
1920	64
1921	53
1922	79
1923	89
1924	108
1925	109
1926	125

Despite the regression in 1921 and the pause in 1925, the progress in production was such that in the eight years noted above the industrial and mineral output was increased by more than 100 per cent. For a large and industrially advanced country like France that was a tremendous achievement. It must be borne in mind, however, that the composite index numbers given above are average figures, in which slumps in some industries are neutralized by exceptional booms in others. It would therefore be inexact to assume that all branches of French production show a continuous record of growth. Furthermore the starting point (1919) from which this doubling of output was measured was an abnormally low one. The progress consisted rather in a rapid recovery from injury than in a phenomenal expansion. Supposing again that there had been no war, and that the 1907–1913 rate of industrial growth had continued without interruption or change, then the index number of French production in 1926 would have stood at 150 instead of 125. Nevertheless, even after taking these considerations into account, one is left with the impression that French industrial and mineral production made very notable gains in the post-war years.

France was, indeed, much more fortunate than Great Britain from the point of view of the resuscitation of industrial activity after the war. The fact is that at no time from the close of hostilities on through 1926 did Great Britain ever surpass her 1913 level of production. This has given rise to the problem of British unemployment, while France has remained relatively immune except for very short periods during the post-war years. *The London and Cambridge Economic Service* has computed index numbers of physical production which include agriculture as well as manufacturing and mining.[8] By excluding agriculture, index numbers of British industrial and mineral production are obtained which are more comparable with the Dessirier index numbers for France.

Year	*L. & C. composite index numbers of industrial and mineral production in Great Britain*
1913	100
1920	90
1921	63
1922	78
1923	84
1924	88
1925	86
1926	68 [a]

[a] The 1926 index number was computed from the following figures communicated by Mr. Rowe: Index number for all industries for 1926 = 79.8 on base 1907–1913, and for agriculture = 95.2. Owing to the coal strike these 1926 figures must be treated with great circumspection.

According to these index numbers, physical production — excepting agriculture — remained between 10 and 15 per cent below the 1913 figure.

The London and Cambridge computations have been criticized as underestimating the real progress of British post-war industrial activity. But the index numbers of *The Economist* (London), which are higher, still show that production in Great Britain after the war was inferior to production in 1913, except for the year 1925 when it just equalled the 1913 standard:

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[8] J. W. F. Rowe, "An Index of the Physical Volume of Production," *The Economic Journal*, June, 1927, p. 178.

Year	"The Economist" *index numbers of production in Great Britain*[9]
1913	100
1920	95
1921	80
1922	86
1923	95
1924	98
1925	100

It is evident that, whatever the basis of calculation may be, the course of production in Great Britain was very different from that of France.

At the beginning of the post-war period, Great Britain had a distinct advantage over France. In 1920 British production stood at 90 or 95, while the French index number was 64. This was due, no doubt, to the fact that Great Britain's industrial life was not materially wrecked by the actual fighting, and was consequently less disrupted. In 1920, the year of reawakened demand for peace-time economic goods, British industry profited. Then, however, a long period of falling prices set in, culminating in the return of the pound sterling to the gold standard at par. British goods were soon out of reach of foreign customers on the European continent, who, for the most part, had nothing but rapidly depreciating currencies with which to buy. The chaotic state of the European market resulted in a serious loss to Great Britain, because of the dependence of many of her industries on foreign outlets for their products. The general industrial distress was further aggravated by a succession of widespread strikes.

Probably the only advanced country which exceeded France in the rate of post-war industrial development was the United States. The following index numbers of physical production were computed from figures published by the *Harvard Economic Service*, and they show approximately the course of manufacturing and mining activity in the United States:

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[9] Rowe, *op. cit.*, p. 180.

Year	*Index numbers of industrial and mineral production in the U. S. (Computed from* "Harvard Economic Service" *index numbers)* [10]
1913	100
1919	104
1920	109
1921	84
1922	112
1923	133
1924	125
1925	138
1926	144

It is evident from these figures that the industrial and mineral output in the United States in 1926 was nearly a half greater than in 1913, while in France the increase during the same interval was one of only 25 per cent.

It is difficult to obtain precise measurements of production in other countries. In Germany, the path of post-war industrial progress was strewn with many obstacles, the greatest being the collapse of the currency and the difficulties of adjustment after stabilization. Both before and after the monetary crisis there was a marked tendency toward expanding production, but it was hardly comparable with the industrial progress of France. Austria suffered most grievously during the post-war period, so that her production was extremely low. Italy too met with exceptional difficulties of one kind or another in the first four years after the war. Spain, however, made very important progress. Certainly in comparison with her neighbors France showed an extraordinary record of industrial development, which was partly due to her energy in reconstructing the war-devastated areas, and partly to the new basic resources acquired by the terms of the Treaty of Versailles.

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[10] Source: *Review of Economic Statistics*, in which the index numbers up to 1919 were calculated on a 1909–1913 base, and after 1919 on the base 1919 = 100. The index numbers given above were computed on the base year 1913 by dividing the 1919 index number (base 1909–1913) by the 1913 index number (base 1909–1913) and then multiplying the index numbers (base 1919) from 1920 on by the quotient. The manufacturing and mining figures were combined by weighting the former by 7 and the latter by 1.

2. Post-War Agriculture

French agriculture showed no such remarkable progress as did French manufacturing and mining. The index numbers in the column below reveal the status of post-war agricultural production from year to year, as compared with the same production in France and Alsace-Lorraine from 1909 to 1913:

Year	*Index numbers of agricultural production in France and Alsace-Lorraine* [11]
1909–1913 (average)	100
1919	70
1920	71
1921	76
1922	87
1923	86
1924	96
1925	100
1926	82

Only in 1925, which was a year of exceptionally favorable weather conditions, did the products of the field attain their pre-war level. The average annual agricultural output from 1922 to 1926, when the area under cultivation in France and Alsace-Lorraine was more nearly the same as in the years from 1909 to 1913, fell short of the yield before the war by about 10 per cent.

The lack of labor, which was seen to be so detrimental to cereal crops in 1919, continued through the whole post-war period. As the index numbers show (see next page), forage crops which require less attention increased at a notably more rapid rate. Moreover, the proportion of land given over to forage crops after the war was constantly increasing, and even exceeded the pre-war area, while the surface devoted to cereals diminished and was about 18 per cent below the 1909–1913 acreage. On the whole, the proportion of arable land under cultivation during the years 1922–1926, that is, after the most devastated portions of French territory had been cleared, was only about 92 or 93 per cent of the proportion cultivated in 1909–1913.

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[11] The computation of these index numbers is described on p. 481, note 12. The value of the products included represents probably 65 or 70 per cent of the value of the total French produce.

	Index numbers of agricultural production in France and Alsace-Lorraine	
Year	*All cereals*	*All forage crops*
1909–1913 (average)	100	100
1919	54	65
1920	74	83
1921	84	65
1922	75	84
1923	84	84
1924	85	99
1925	85	103
1926	79	88

The agricultural situation in Great Britain is hardly comparable with that of France, because it occupies a much smaller part in the economic life of the nation. Up to 1925, as is indicated in the index numbers given below, British agricultural production also remained below its pre-war level, but it was not quite as much in arrears as the French production. In 1925 the British yield even exceeded, to a slight extent, the average 1907–1913 crops:

Year	*L. & C. index numbers of agricultural production in Great Britain*[12]
1909–1913 (average)	100
1920	89
1921	85
1922	94
1923	91
1924	95
1925	101
1926	95

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[12] J. W. F. Rowe, *op. cit.*, p. 178. The 1926 index number was computed from the figure communicated by Mr. Rowe. See above, p. 102.

In the United States, where farming conditions are so very different from those of France, again rendering comparisons extremely hazardous, agricultural production during the post-war years was on the average about 10 per cent above the annual production of 1909–1913:

Year	*Index numbers of agricultural production in the United States (Computed from* "Harvard Economic Service" *index numbers)*[13]
1909–1913 (average)	100
1919	111
1920	121
1921	100
1922	111
1923	111
1924	112
1925	112

It thus appears that while agricultural production in France and Alsace-Lorraine had never fallen as low as industrial production after the war, it did not make so marked a recovery toward the pre-war norm, nor such excellent progress. Indeed, post-war France, in the rate of increase of the agricultural yield, fell behind not only the United States, but Great Britain as well.

3. The Growth of Transports

In modern times the process of production does not end with fabrication or with the gathering in of the harvest. The geographic division of labor within any nation is such that the industrial centers and the cultivated areas are more often than not at a considerable distance from the places where the products are consumed. If most French commodities manufactured in the north and northeast of France, and if the bulk of farm crops grown in the west and south, had to remain where they were produced, for all practical purposes they might not have been produced at all.

[13] Source: *Review of Economic Statistics*. See above, p. 104, note 10.

Transportation is a necessary sequel to production and in fact an integral part of it.

The growth in the volume of freight transportation by railway in post-war France was more or less parallel with the expansion in French industrial output, as will be seen by comparing the figures below with the index numbers of industrial and mineral production:[14]

Year	*Index numbers of railway freight traffic on main lines in France and Alsace-Lorraine* [15]
1913	100
1919	59
1920	83 [a]
1921	80
1922	92
1923	102
1924	116
1925	111
1926	122

[a] Computed on basis of freight carried in France alone, not including Alsace-Lorraine.

Thus in 1919 the number of tons of freight transported on French railways was 41 per cent lower than the weight carried in 1913. This corresponded very closely indeed with the depressed state of industry immediately after the war. The increase from that year on was strikingly rapid and almost uninterrupted right up to 1926. In 1921 the progress in railway freight traffic was only slightly retarded, for the falling off from the preceding year amounted to less than 4 per cent. In the same interval, the volume of industrial production had shrunk 17 per cent, that is, more than four times as much. This discrepancy is due partly to the fact that foreign imports of manufactured goods were very considerable during the early years after the war, and partly to the fact that the great quantity of imported building materials rapidly moved towards the north for reconstruction, entered into the freight traffic index numbers and not into the Dessirier composite industrial production numbers. On the other hand, the arrested development in production in 1925 was accompanied by 4.5 per cent shrinkage in the volume of railway freight. It will be observed, furthermore, that the amplitude of the post-war increase in railway freight traffic was greater than that of the general expansion in industrial activity. The explanation probably lies in the fact that the development of heavy industries in France since the war entailed an unprecedented movement of coal and metal products, and that there was a falling off of waterway shipments in favor of railway transportation.

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[14] See above, p. 101.

[15] Derived from data published by the *Revue Générale des Chemins de Fer*. The data for Alsace-Lorraine were communicated by the Office des Chemins de Fer d'Alsace-Lorraine.

The growth of railway freight traffic was favored by the relatively low price of this kind of transportation. The cost per ton-kilometer certainly increased in the post-war period, but not in proportion with the rise in the general level of wholesale prices. The average charge per ton-kilometer for all goods carried was 4.12 centimes in 1913, and 15.96 centimes in 1925. The rise was one of 388 per cent while the wholesale prices increased 550 per cent. When shippers raised a hue and cry about oppressive freight costs, as was frequently the case in the post-war period, they based their plaints upon rates affecting particular commodities rather than on the average level of rates, which was such as to foster trade rather than to discourage it.

In the transportation system of France the rivers and canals that form a dense network over the territory are hardly less vital to the completion of the productive process than railways. It is extremely difficult, however, to compare post-war and pre-war freight traffic on French internal waterways because there are no data available for the weight of water-borne goods carried in Alsace-Lorraine alone, as distinct from the rest of Germany before the war, or from the rest of France after the war, except for the year 1920. On the basis of a rough estimate, assuming that the ratio of internal navigation shipments in Alsace-Lorraine to the rest of France was the same in 1913 and 1919 as in 1920, the following index numbers have been computed:

Year	*Index numbers of internal navigation shipments in France and Alsace-Lorraine* [16]
1913	100
1919	41
1920	47
1921	39
1922	61
1923	68
1924	74
1925	75
1926	79

The fact is that in 1926 the number of tons of merchandise shipped on canal and river barges in France and Alsace-Lorraine was more than 7 per cent less than the number of tons carried in France alone on the eve of the war. The reason for the very marked decline in waterway freight traffic during the early post-war years was probably the crippled state in which the main canal systems in the north of France were found on the close of hostilities. The continued depression after 1922 was due to a complex combination of causes, partly inherent in the French internal waterway system itself, partly ascribable to chaotic monetary conditions, and partly arising from intense railway and auto-truck competition. Suffice to say that the above index numbers need not be taken as symptomatic of any diminution in the total volume of goods transported in France, for in 1913 waterway freight represented 20.5 per cent by weight of railway freight, and in 1926 it represented only 13.2 per cent of the latter.

4. THE EXPANSION OF FOREIGN TRADE [17]

Foreign trade consists, in final analysis, in the movement of commodities to and fro across national boundaries, and this form of transportation is just as much an integral factor of production as domestic transportation. The progress of French foreign trade cannot be measured as precisely as might be desired, and that for several reasons. In the first place comparisons in terms of the value of imports and exports are bound to be inaccurate because of the constantly shifting value of the franc in the period considered. In the second place, comparisons in terms of weight are no less faulty, because from 1913 to 1926 the unit of national territory for which statistics of French foreign trade were published was changed twice. In 1919 Alsace-Lorraine was reannexed to France, but there are no separate foreign trade statistics available for that region either before or after the war. Again in 1925, when the Saar territory was included within the customs union of France, the exports and imports of this important industrial district to and from countries other than France were added into the French foreign trade figures, and no distinct account for the territory was kept. These deficiencies in official statistics are very serious, for they render it impossible to trace the course of the expansion of French foreign trade for any constant territorial unit. All that can be set forth is the record of the growth of exports and imports of the French nation, irrespective of the changing area.

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[16] Derived from data published by the *Statistique Annuelle de la Navigation Intérieure.*

[17] All figures relating to French foreign trade were obtained, unless otherwise indicated, from the *Statistique Mensuelle du Commerce Extérieur de la France*, designated before 1923 as *Documents statistiques publiés mensuellement par l'Administration des Douanes sur le Commerce de la France* (Ministère des Finances, Direction Générale des Douanes, Paris, Imprimerie Nationale, 1897–1928). Hereafter this source will be referred to in this volume as *Stat. Mens. Com. Ext.*

Although unavoidably inaccurate, the following index numbers give a fair notion of the post-war development in French foreign trade. The first column gives the percentage relationship which the total weight of exports from 1919 on bore to the total weight of exports in 1913. The second column is based on the values of total exports, but as these values were originally expressed in depreciated francs which were constantly fluctuating, they have been deflated on the basis of the wholesale price index numbers of the *Statistique Générale de la France:*[18]

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[18] The index numbers relating to value would have been higher if the wholesale price index numbers of the Federal Reserve Board, or some other price index numbers combining wholesale and retail prices and the cost of living, had been used instead of the index numbers of the *Statistique Générale.*

Year	*Index numbers of French exports relating to*	
	Weight	*Value (expressed in terms of francs of 1913 purchasing power)*
1913 (not including Alsace-Lorraine)	100	100
1919 (including Alsace-Lorraine)	25	48
1920 " " "	58	77
1921 " " "	73	83
1922 " " "	103	95
1923 " " "	113	106
1924 " " "	133	123
1925 " " "	130[a]	119[a]
1926 " " "	140[a]	121[a]
1927 " " "	166[a]	128[a]

[a] Computed on the basis of estimates of exports from France exclusive of the Saar. See below, p. 525, note 12.

The above index numbers show clearly to what a distressingly low level exports had fallen once the war was over. From the very first, however, the recovery took place with remarkable rapidity and soon the volume of goods leaving French soil surpassed anything that had ever been known before. Not even in the years of depression which followed the boom of 1920 did exports show any tendency to decline. This was probably due, however, to the poor state of French exports in the first two years after the war. In the year 1925, during which was recorded an arrested development in production and a decline in railway freight, there was also a slight diminution of exports. While it cannot be said definitely whether French exports from 1923 on were greater or less than the exports of France and Alsace-Lorraine combined in 1913, there can be no doubt of a very notable expansion in the latter years.

The course of French imports is described on the next page in the following two series of index numbers which are analogous to the index numbers just examined.

	Index numbers of French imports relating to	
Year	*Weight*	*Value (expressed in terms of francs of 1913 purchasing power)*
1913 (not including Alsace-Lorraine)	100	100
1919 (including Alsace-Lorraine)	87	120
1920 " " "	114	117
1921 " " "	91	76
1922 " " "	116	87
1923 " " "	124	93
1924 " " "	128	97
1025 " " "	113 [a]	96 [a]
1926 " " "	109 [a]	101 [a]
1927 " " "	117 [a]	102 [a]

[a] Computed on the basis of estimates of exports from France exclusive of the Saar.

The movement of imports was very unlike that of exports even in the early post-war years. There was an urgent need of vast quantities of goods from abroad in the two years following the close of hostilities, while French industry in the north was undergoing restoration. Much plant equipment was imported at that time to replace war-damaged and destroyed machinery. With her principal mines in the north flooded and wrecked, France was forced to import an abnormal tonnage of coal, until her own mineral resources were set in working order again. It was hardly to have been expected, therefore, that imports should follow in the same progressive path as exports in the post-war years, in view of the very different starting point. Moreover, monetary depreciation was, as will be seen, not without its effects on the relative expansion of exports and imports.

The foreign trade of post-war France was different from that of pre-war France not only in volume but in the general nature of commodities exported and imported. There was, for example, a change in the proportion of manufactured goods exported to total exports, as is seen in the table on the next page.

Year	*Percentage ratio of the value of manufactured exports to the value of total exports*
1913 (not including Alsace-Lorraine)	60.8
1919 (including Alsace-Lorraine)	69.4
1920 “ “ “	67.5
1921 “ “ “	68.8
1922 “ “ “	64.0
1923 “ “ “	62.7
1924 “ “ “	65.2
1925 (including Alsace-Lorraine and the Saar)	63.9
1926 “ “ “	63.5
1927 “ “ “	59.8

The reannexation of the great manufacturing region of Alsace-Lorraine and the general development of French industry since the war helps to explain both the absolute and relative increase of manufactured exports. The fall in the ratio of the value of manufactured exports to the value of all exports in 1927 was due not so much to any decline in the value of manufactured exports (it was, in fact, almost stationary from 1926 to 1927 in terms of francs of 1913 purchasing power), as to an extraordinary rise in the ratio of the value of industrial materials exported. This rise was caused principally by a swelling in the exports of semi-manufactured industrial materials, like metallurgical products. With respect to the industrial activity involved (see Chapter XI), the distinction in foreign trade statistics between manufactured goods and industrial materials is highly artificial. Consequently the drop in the 1927 figure of the preceding table does not invalidate the conclusion that there was a relative increase in the value of exports through the whole post-war period as compared with the pre-war years.

The same facts would lead one to anticipate a corresponding diminution in the proportion of manufactured goods imported to total imports. That such was indeed the case is seen in the following table:

Year	*Percentage ratio of the value of manufactured imports to the value of total imports*
1913 (not including Alsace-Lorraine)	19.7
1919 (including Alsace-Lorraine)	28.9
1920 " " "	25.8
1921 " " "	21.9
1922 " " "	18.5
1923 " " "	13.2
1924 " " "	12.7
1925 (including Alsace-Lorraine and the Saar)	12.3
1926 " " "	12.7
1927 " " "	10.9

The contraction of 56 per cent in the ratio of manufactured imports to total imports between 1919 and 1926 is partly due to the fact that the depreciation of the currency rendered goods imported from countries with a higher monetary standard disproportionately expensive as compared with the price of domestic commodities. It is due also to the expansion of French industrial production which naturally sought a home market.

It is important to note in this connection that the relative decline in imports does not of itself necessarily imply an extraordinary development of domestic manufactures. It is the common experience of highly industrialized nations to intensify their production along a few highly specialized lines, and as they do so to increase rather than decrease the sum total of manufactured imports. France before the war had been a fairly specialized industrial nation, but the declining importance of manufactured imports leads one to suspect that after the war she tended to become less specialized.

Whether it took place along the lines of more or less specialization, the general post-war aggrandizement of industrial production was an undisputed fact, and it had yet another effect on the nature of French imports. The proportion of raw materials coming from abroad to total imports loomed steadily larger from year to year after 1919 and soon went beyond the 1913 ratio:

Year	*Percentage ratio of the value of imported industrial materials to the value of total imports*
1913 (not including Alsace-Lorraine)	58.7
1919 (including Alsace-Lorraine)	41.2
1920 " " "	50.4
1921 " " "	51.7
1922 " " "	58.6
1923 " " "	63.8
1924 " " "	64.9
1925 (including Alsace-Lorraine and the Saar)	67.0
1926 " " "	67.4
1927 " " "	62.7

These figures simply reflect the increasing dependence of France on other countries for such essential raw materials as coal, cotton, wool, silk, rubber, etc., as the industries which require them expand.

In short, the French foreign trade statistics are indicative of a very marked development of commercial relations with other nations from 1919 to 1926. This was, in fact, an inevitable corollary of the growth of industrial forces in post-war France. The notable increase in exports and the important changes which took place in the nature of imports were all closely related to the striking expansion of manufactures after the war.

5. Progress in Plant Equipment

The extent to which industry and trade can develop in modern nations is determined by the size and efficiency of plant equipment. Nevertheless it is possible for a considerable expansion in production to take place in an industrialized country without any proportional increase in factories, mines, railways, etc., because in most industries the production capacity is built on the basis of an anticipated demand which is generally greater than the average demand. It is, therefore, desirable to inquire into the actual condition of plant equipment in post-war France, since the mere fact of increased output does not necessarily carry with it the implication of enlarged and improved machinery.

Unfortunately, in the absence of comparable statistical records relating to various types of productive mechanisms, it is not possible to make a comprehensive and concise statement of whatever progress France made in plant equipment during post-war years. There are, however, some relevant facts, which, fragmentary though they be, reveal the general trend.

On the eve of the war, as it has already been observed,[19] French factories and mines were apparently not up to the standard which other countries had achieved at that time. There was still a prevalence of antiquated instruments of production in France. This opinion is generally accepted even by the French, and it was brought out rather strongly in the perhaps biased German report on the condition of industry in the occupied regions during the war.[20] At the same time there was always going on in France as in all modern nations a replacement of older machinery by newer types. The modernization of French plant equipment was certainly under way — if only slowly — by 1914.

At the outbreak of the war, when the principal industrial regions of the north were occupied by the enemy and the main sources of many staple products were thus cut off, the French endeavored to compensate the loss by the erection of new factories and the renovation of old plants in other parts of France, especially around Lyons, Marseilles, Bordeaux, Caen, le Havre and Rouen. All of these regions recorded a greatly increased output of mineral and metallurgical products. The strengthening and enlargement of productive capacity at that time took place particularly in those branches of industry which responded to war needs: the textile, metallurgical, mining, electrical and chemical industries.

With the return of peace, the vast and greatly varied manufacturing resources of Alsace-Lorraine were added at one stroke to the industrial equipment of France. There were rich iron mines, giant blast furnaces, immense steel mills, and a multitude of factories, some large and some small, for making woolens, cotton goods, silk and rayon. Since the German market, which in pre-war days had been absorbing the greater part of the products of Alsace-Lorraine, was very seriously curtailed after the war, the sudden acquisition of new productive forces without corresponding commercial outlets had very much the same effect on France as industrial over-equipment.

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[19] See above, Chapter I, pp. 14–16.

[20] *L'Industrie en France occupée* (Ouvrage établi par le Grand Quartier Général Allemand en 1916, Paris, 1923).

The most important post-war ameliorations in plant capacity took place as a result of the reconstruction of industrial property in the devastated north. The extent of war damage was very great, but the French set about to rebuild their ruins with admirable courage and promptness — for, from every standpoint, it was desirable to revive industrial activity as quickly as possible. It proved, also, that restoration was something more than a mere matter of dire necessity; it was an opportunity to replace worn and patched machinery by new and highly efficient equipment.

The following data [21] indicate roughly the magnitude of the task of reconstruction which France accomplished. When hostilities ceased, 9,300 factories employing at least 10 persons each were found to have been damaged or destroyed; by January 1, 1926, 8,200 had been rebuilt or repaired. In the process of restoration, many smaller units were merged into larger ones, so that so far as factories are concerned reconstruction may be considered as having been completed within seven years after the war. In the same interval practically all of the 200 shafts in the coal mining region of the départements of the Nord and Pas-de-Calais, which had been more or less destroyed, were not only repaired but improved. Electrical apparatus was installed and the number of pneumatic pick-hammers, which had been only 1,600 in 1913, was increased to 17,300 in 1925. Perforating hammers, of which but 2,600 had been in use in 1913, numbered 7,100 in 1925. Of the 33,000 company-owned miners' dwelling houses which had been razed or damaged, 30,000 were rebuilt by 1925 — most of them attractive modern brick houses. About half the length of the total galleries in the iron mines of France had been damaged, and these were all restored to working order. The textile mills

[21] J. R. Cahill, *Report on the Economic Conditions of France, 1923–1927.*

were not as seriously affected as many other kinds of factories, though it is estimated that in the north of France over half of the looms and spindles were more or less impaired. Within very few years after 1919 nearly all trace of this damage was removed, either by the replacement of the copper parts of machines which had been taken away by the invading armies or — what was often found simpler — by the installation of entirely new machinery. The kilometers of roads, railways and canals, and the numerous bridges and viaducts which had been wrecked, were nearly all rebuilt at the same time as new industrial equipment rose from the ashes of the old.[22]

There were, in addition, many notable improvements in the productive apparatus of France from 1919 to 1927, which were not directly attributable to the war or the Treaty of Versailles. For example, the blast furnace capacity was increased, and the construction of the newer types of coke-ovens was pursued with vigor in the north. These were evidences of expansion not only in metallurgy, but also in the chemical industry, since extensive provision was made for the recuperation of coke-oven by-products such as ammonia, benzol, pitch, combustible gases and other coal tar products. This was a fresh departure, since the manufacture of staple chemicals had been very little developed in France before the war. Moreover, after the war, France, together with other countries, came into possession of hundreds of dye processes which had previously been monopolized and kept secret in Germany.

In machine trades there was much improvement of equipment during the war in order to satisfy the extraordinary demand for manufactured metal articles. After the war the progressive amelioration continued, as the automobile trade took on unprecedented proportions, and as other industries calling for massive supplies of machinery developed. Such were the hydro- and thermo-electric industries, the rubber industry, and the industries engaged in the manufacture of electrical apparatus, of rayon and of heavy chemicals. The installation of hydraulic machinery was especially noteworthy in France, because of her exceptional resources and her urgent need to conserve coal.

[22] See above, Chapter I, p. 20.

The productive capacity of industry in France was further enhanced by the invasion of many foreign firms which set up on French soil factories of their own with the most efficient mechanical devices of their several countries. The post-war multiplication of foreign owned factories was, in part, a continuation of a tendency which had already existed before the war. It was due also to the depreciation of the currency, which, together with the increased tariff rates, made it more feasible for foreigners to manufacture in France, where the costs of production were low, than to import into France commodities made in their home countries of a higher monetary standard.

Currency disturbances which were so favorable to outside firms exercised a decidedly detrimental influence on the general progress of French plant equipment. From 1924 to 1927, when the shortage of capital was most acutely felt, numerous undertakings for the electrification of railways, or for the amelioration of ports, or for the consummation of the final stages of reconstruction in the devastated areas, had to be stopped. In that period all but the most urgent programs for public improvements connected with roads, canals, postal service, etc., had to mark time until the state budget began to show adequate surpluses.

These were the outstanding features of the development of industrial technique and manufacturing capacity in France after the war. At the same time other countries were making more or less the same progress, for the constant betterment of mechanical devices of production is an international process. The post-war achievement of France was, however, an exceptional one. In a relatively short period, under the influence of powerful stimuli to change, the French industrial equipment, which had been notoriously obsolete, was completely transformed in a great many branches of production and brought up to the highest standards of efficiency.

CHAPTER VI

SOME EFFECTS OF INFLATION ON TRADE

It is one of the axioms of modern economic life that the object of all industrial production is sale — that is to say, trade. The notable increase in post-war production just examined must, therefore, reflect an equally notable expansion in trade, except in so far as some small part of production purported simply to replenish manufacturers' stocks diminished during the war. It is generally agreed, also, that the volume of trade is a function of price. The influences affecting price movements are very numerous and extremely complex; and not least among them in post-war France were the inflation of currency and the accompanying financial disturbances. The coincidence of monetary inflation and of an increasing industrial output seems to imply a causal nexus. As such causal action must have taken place mainly *via* the effects of inflation on trade, this subject will be treated now, reserving the effects of inflation on industry for investigation in the following chapter.

The supposition that any relation of cause and effect may exist between inflation and expanding trade carries with it, apparently, the inference that inflation is a good thing for sales and manufactures, whereas it is usually regarded by economists as the most deadly of financial sins. However reprehensible a sudden swelling in the quantity of purchasing power may be, it is almost universally conceded to have a stimulating effect on trade and industry, at least for a time. There is much uncertainty as to what its more lasting consequences are. The French data available for seven eventful years after the war cast a certain amount of light on the contradictory aspects of this problem.

The data are by no means simple, for the influence of monetary inflation on trade and industry is more extended and complicated than is ordinarily suspected. It is extended because it penetrates every phase of economic life. There is hardly a step in the industrial process, for example, where monetary transactions do not intervene. When, therefore, money changes brusquely in value, the repercussions are far-reaching and innumerable. The effects of inflation are extremely complicated because of the intricate interrelations of the component parts of the modern economic organization. The theory of the influence of inflation is thus necessarily composed of complex hypotheses. These will be set forth as the particular points are investigated.

Inflation is generally conceived of as a sort of distention of the amount of money in circulation, not with air, but with something almost as valueless, paper. An inflated currency can, therefore, be bought cheaply with uninflated or less inflated money of other countries, or with goods. Inflation is consequently often measured by rising prices either of other moneys (exchange) or of commodities. As prices are never, even in most normal times, wholly stable, the measure of inflation becomes a matter of appreciating degrees of change. It is practically impossible, for example, to find a given point in the movement of prices and say: all beyond this point is inflation and all on that side is not inflation. Commonly it is rather the extreme price increases, particularly of foreign moneys as expressed in rising exchange rates, that are regarded as manifestations of inflation.

The era of contemporary inflation in France may be divided into the war epoch and the post-war epoch. It was during the war that the first effects of ample inflation were felt. At the close of hostilities wholesale commodity prices were three and a half times what they had been in 1913, that is to say, the franc could purchase on the wholesale market only between a third and a fourth as much as before the war. What foreign moneys the franc could buy is not known, since a free foreign exchange market did not exist. This study is, however, primarily concerned with the post-war experience.

From the close of the war, that is, from the beginning of 1919 to the late spring of 1920, the franc fell enormously in value, the Government borrowed heavily from the Bank of France, and the money in circulation increased. Between January 1919 and April

1920, the advances from the Bank of France to the State rose 28 per cent, and the bank-note circulation passed from 31.8 billion to 37.3 billion of francs while wholesale prices advanced 69 per cent. This all took place in a short period of only 16 months. In view of the fact that from every economic standpoint the months that immediately followed the war were very abnormal: what with the factories in the north still paralyzed, with foreign and domestic trade disrupted and with currencies almost everywhere collapsing, the first post-war inflation period is a poor one in which to observe the effects of inflation.

From the summer of 1920 to the early months of 1922, the reverse tendency set in, marking a period of deflation. Wholesale prices fell 48 per cent from April 1920 to February 1922. At the same time, circulation decreased to 36.2 billion, and the advances from the Bank of France shrank by more than 10 per cent. This general monetary deflation was accompanied by a very severe industrial crisis which lasted through most of 1921.

The business revival and boom which began at the close of 1921 and continued through 1922 were characterized by a sharp rise in prices during the latter year. In the first part of 1923, when the Ruhr was invaded by French troops, prices, production and the value of the franc in terms of dollars all fell. The amount of bank notes in circulation, however, did not begin to rise definitely until the latter part of 1923, when the movement was indeed rather slight. In fact, the first two-thirds of 1923 was an integral part of a fairly well defined period beginning with the early summer of 1920 and continuing up to the autumn of 1923; and this period was generally characterized by deflation and depression followed by recovery.

The inflation that set in at the close of 1923 was far from acute. It was only just barely perceptible for more than a year. Indeed during 1924 there was little that could properly be called inflation. The bank-note circulation increased from 38.3 billion in January of that year to 40.6 billion in December. Wholesale prices rose no more than 3 per cent in the same 12 months' interval, while the exchange value of the dollar in terms of the franc actually diminished by about 14 per cent. True, in February of 1924 both prices and the exchange rate of the dollar in terms of francs suddenly rose to hitherto unprecedented heights, but that was a very momentary phenomenon. The threatening crisis was averted thanks to the Morgan loan contracted by the Poincaré Government; and thus from February to April exchange rates and wholesale prices declined sharply.

It was not until 1925 that inflation began to manifest itself unmistakably, and it continued with increasing acuteness up to August of 1926. The note circulation rose from 40.5 billion in January 1925 to 56 billion in July of the following year, representing an increase of 38 per cent. Government borrowings from the Bank of France, which amounted to 21.2 billion in January 1925, reached the figure of 37.5 billion in July 1926. Meanwhile the wholesale price index number moved from 514 to 836, and the number of francs required to purchase a dollar rose from 18.5 to 41. A strong reaction set in, beginning with the month of August 1926, and the deflation movement continued more or less rapidly to the end of the year. In the spring of 1927 the exchange was held stable, prices fluctuated within relatively narrow limits, and circulation remained around 52 billion. Thus there was marked off fairly clearly a second period of positive inflation, from the beginning of 1925 to midsummer of 1926, which was analogous in certain respects to the first inflation period in the year and a half that immediately followed the war.

Not all of the eight post-war years, therefore, were characterized by increasing inflation. To be sure, throughout the whole epoch from 1919 to 1927, the French currency remained depreciated, that is to say, the franc was worth less in gold than it had been before the war. Moreover, wholesale prices were higher than they had ever been before; and most of the time the price of the dollar in terms of francs was higher than the relative rise in wholesale prices in France and the United States would seem to justify. It is important to bear in mind that this state of affairs does not necessarily constitute inflation, for inflation is a process and not a static condition. Even the pre-war, so-called "normal" gold, commodity and exchange values of the franc were the consequence of innumerable economic and monetary crises which had taken place in the course of the centuries that preceded. Likewise, much of the depreciation from which the franc suffered after the war resulted from war-time rather than post-war inflation. It was from 1913 to 1919 that French monetary circulation increased threefold, or thereabouts, and never again did it increase nearly as much. There is nothing in the annals of the post-war wholesale price movement to equal the 356 per cent rise from 1913 to 1919. Even between February 1922, when post-war prices were lowest and July 1926, when they reached their peak, the rise was only 273 per cent. Because of the artificial restraints which prevented the foreign exchange market from functioning freely during the war, a similar comparison cannot be made between the fall in exchange value of the franc during and after the war.

There were, consequently, only two post-war periods, each of a year and a half duration, in the course of which inflation was actually in process. Only then did circulation increase out of all proportion with business requirements, and government borrowings swell alarmingly, and prices soar to distressing levels, and exchange rates of gold currencies rise to dizzy heights. The other post-war years — from May 1920 to January 1925, and after July 1926 — were characterized by deflation, business depression and revival, and other phases of current economic change. In fact, even the two definitely distinguishable inflation periods of post-war France were relatively calm, partaking rather of the nature of an upward movement in the business cycle than of the panic and tragic collapse which befell Germany and Austria and other countries to the east.

1. Inflation and Export Trade

Inflation, being always accompanied by sharp price movements, affects trade at every step in the economic process. The purchases and sales of labor, raw materials and plant equipment are no less influenced than the purchases and sales of consumers' goods. Moreover the activity of the domestic market is no less disturbed than that of the foreign market, but in the latter case it is more obvious, more spectacular and more easily measured. Because it is so obvious, the theory that inflation stimulates exports — at least, temporarily — has long been one of the commonplaces of current economic doctrine.

The underlying reason why the volume of exports expands in periods of inflation is that the value of a depreciating currency generally falls more rapidly in terms of non-inflated moneys of other countries than in terms of domestic commodities. A foreigner can usually buy depreciated currency more cheaply. If, however, prices in the country affected by inflation rise to the same extent as the currency falls in exchange value, then clearly foreigners gain nothing by depreciation. It is only when, within a given country, prices do not rise in the same proportion as exchange value falls that outsiders find a special advantage in buying in that country.

The index numbers of wholesale prices and the exchange quotations of the franc indicate that France remained throughout almost the whole post-war period attractive to buyers from gold-currency countries. In July 1926, the number of francs that an American buyer could get for one dollar was 40.96 (monthly average), whereas before the war he could obtain only 5.18 francs for the dollar. The franc had fallen in value about 87 per cent. In the same month wholesale prices were 8.4 times as high as they had been in 1913, which is the same as saying that the value of the franc in terms of commodities had fallen about 88 per cent. It would appear, therefore, that the American buyer could find no greater advantage in making purchases in France at the very height of inflation than before the war. Nevertheless, July 1926 proved to be a most propitious time for American buyers to operate in France, despite the fact that French prices had risen even more than the foreign exchange value of the franc had fallen. The reason is simply that the gold dollar itself had depreciated in purchasing power since 1913 in the United States; and in July 1926 it was worth only about two-thirds of its 1913 value in terms of commodities. Only if French wholesale prices had risen much higher — nearly 50 per cent higher — would any real parity between the purchasing power of the dollar and that of the franc have been attained.

It is always necessary, therefore, in comparing the depreciation of the franc in terms of commodities with its depreciation in terms of dollars to bear in mind that the dollar itself is not a constant but a variable.[1] If the French wholesale price index for July 1926 be divided by the United States wholesale price index for the same month, then it will be found that French prices had risen since 1913 five and a half times as fast as United States prices. At the same time, however, the number of francs that a dollar could buy rose even faster than that, for in July 1926, the dollar was worth about eight times as many francs as in 1913. If, by this sort of calculation, the commodity value of the dollar be reduced to a constant factor, it is seen how advantageous it was for Americans to buy in France during the inflation crisis.

The accompanying chart (Chart IV) shows that, with the exception of a very brief period in 1922, exchange and wholesale price conditions favored exports to the United States from December 1919 right through June 1927.[2] The curve of the index of the price of the dollar in terms of francs remains almost constantly above the curve of the French wholesale price index divided by the United States wholesale price index. The magnitude of the difference above the price index ratio represents the degree of favorableness for American purchasers of French commodities. The bottom curve on the diagram depicts the fluctuations in this difference (in percentages of the lower curve) from month to month, and shows at the same time the discrepancy between the actual wholesale purchasing power of the dollar in France and the theoretic purchasing power parity, which would really have prevailed if the two upper curves coincided.[3] It will be observed that the discrepancy above the parity line was greatest during the two periods of acute inflation, first in 1920 and again in 1925 to the end of July 1926. During the deflation period of late 1920 and in 1921 the degree of discrepancy above parity diminished, and indeed in April 1922 the dollar index curve fell below the comparative wholesale price index curve. In the latter part of 1922, on the other hand,

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[1] There is an inherent weakness in all these computations, for in the absence of any measurable data regarding the variations in the quality of the commodities whose prices make up the wholesale price index, it is assumed that the quality is constant.

[2] For data see U. S. Bureau of Labor Statistics, *Monthly Bulletin*, and *Bulletin de la Statistique Générale de la France.*

[3] See below, p. 134, note 7.

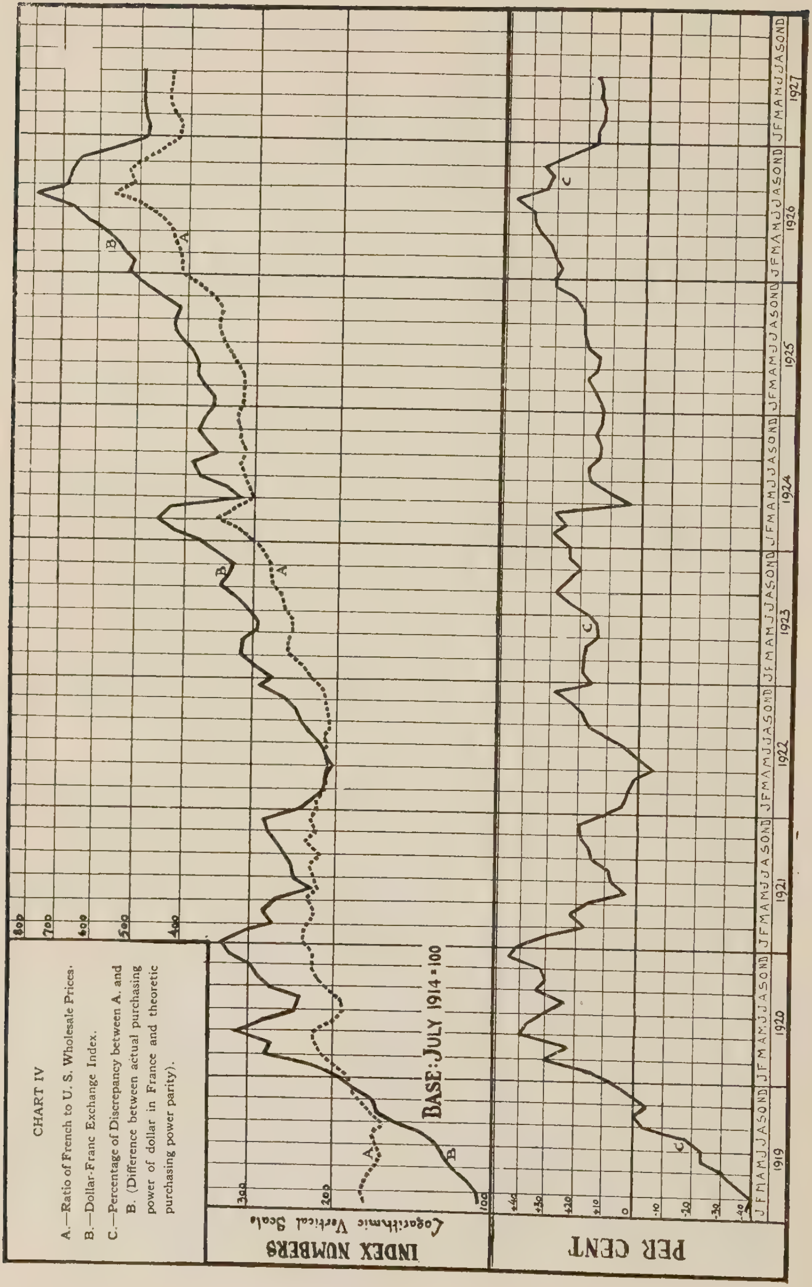

CHART IV

A.—Ratio of French to U. S. Wholesale Prices.

B.—Dollar-Franc Exchange Index.

C.—Percentage of Discrepancy between A. and B. (Difference between actual purchasing power of dollar in France and theoretic purchasing power parity).

and in 1923 conditions became again favorable to American buyers, in fact more favorable than in 1924 or early 1925.

These curves, however, are not to be taken altogether at their face value. They are subject to interpretation and limiting qualifications. For example, the wholesale price ratio curve was constructed on the basis of general average price levels current in the United States and France. Since most of the 45 articles the prices of which go to make up the French wholesale price index number (*Statistique Générale de la France*) are foodstuffs and raw materials for industry, which form a very small part of the exports to the United States, the movement of these figures may have little in common with the comparative trend of prices of the particular commodities more commonly exported from France to the United States. The policy of American buyers is not determined by a comparison of the average prices prevailing in the United States and France, but by the comparison of prices of definite categories of French goods for which there is a market in the United States. It is only when the prices of such commodities, plus insurance, tariffs, and shipping charges, quoted in dollars at the current rate of exchange, have not risen as much in France as in the United States that the American buyer enjoys any particular advantage from the inflation of the franc.

Thanks to the French price indices compiled by the Federal Reserve Board, beginning with January 1920 but unfortunately discontinued after 1925, it is possible to confirm roughly the accuracy of the conclusions derived from the preceding curves, at least for a six-year period.[4] The Federal Reserve Board computed index numbers for prevalent domestic wholesale prices and also a separate series for the prices of French exports. As is clear from the diagram on page 130 (Chart V), both the domestic and export prices follow very much the same path, and neither of them differs essentially from the wholesale price index series of the *Statistique Générale*.

The only difference in the two curves seems to be that the rise in times of acute inflation and the fall in periods of deflation were more accentuated for the price of exports than for domestic prices. In other words, it would appear that if the price of French exports had been used rather than the general wholesale price level of France in constructing the curve of discrepancy from the purchasing power parity on page 128, the favorableness of the French market to American buyers would probably have been less in periods of acute inflation and greater in periods of deflation than was indicated.

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[4] For data see *Federal Reserve Board Bulletin*.

Nevertheless, the fact that the prices of export goods, according to the Federal Reserve Board index numbers, were maintained at a higher level than domestic wholesale prices from January to July 1920 and from September 1923 to the end of 1925 throws an interesting sidelight not only on foreign trade but on trade in general. It seems, moreover, completely to contradict the theory that the principal, if not the only, virtue of inflation is its stimulating effect on exports. This contradiction is all the more perplexing in view of the fact that during the deflation period from August 1920 to October 1922 the prices of exports were relatively lower than domestic prices. And confusion becomes even worse confounded, when it is seen — as will be shown later — that the volume of exports diminished very noticeably in the case of certain staple commodities

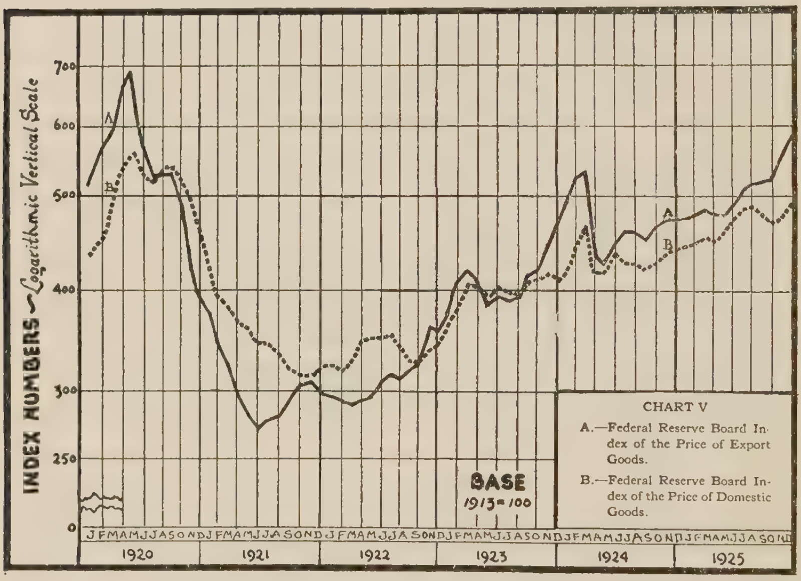

CHART V

A.—Federal Reserve Board Index of the Price of Export Goods.

B.—Federal Reserve Board Index of the Price of Domestic Goods.

during the acute inflation months and actually increased during deflation.

A satisfactory explanation of the paradox, which arises when domestic prices and prices of exports are compared, would call for an analysis of the relative movement of domestic and foreign trade. There is, however, no way of measuring even approximately the volume of domestic trade of France, or of determining its ratio to foreign trade. All that can be done is to formulate conjectures. The available evidence seems to point to an hypothesis which may be stated as follows:

In periods of acute inflation there was a notorious flight from the franc which frequently took the form of extraordinarily large purchases of goods which were supposed to embody more stable value than money. At such times French manufacturers and merchants found a more than adequate market for their commodities at home and regarded their foreign outlets as mere safety valves. No special price inducements were, therefore, offered to American buyers. The prices of exported goods were even a little higher than domestic prices. When, however, the reaction set in, accompanied by rapid deflation and renewed confidence in the franc, then the domestic market was found to be saturated with goods as a consequence of frantic buying during the preceding inflation crisis. French sellers turned consequently to foreign outlets. Competition became keen, and the level of prices of exported goods fell below domestic prices. That is why the exportation of many commodities was more stimulated in periods of deflation than during inflation.

The above hypothesis, even if it were verifiable, would simply explain periodic fluctuations in the advantages open to American buyers in France. Whether the Federal Reserve Board price index of exports, or the *Statistique Générale* wholesale price index be used as a basis of comparison, the fact remains that throughout nearly the whole post-war period French prices were relatively lower than those of gold-standard countries.

A few examples of the post-war prices of individual staple commodities will show even more strikingly the prevailing cheapness of French goods in terms of foreign moneys. In December 1925 a ton of French coal at the mine, for instance, was worth only

80 per cent in dollars of its 1913 dollar value, while English, German, Belgian and American coals were all more costly in dollars than they had been before the war:

Country	*Ratio of dollar price of coal at mines in December 1925 to average dollar price of same coal in 1913*[5]
France	80
Great Britain	123
Germany	124
Belgium	133
United States (November)	191

These figures indicate that in gold prices, coal, which constitutes an important element in the cost of production of most industries, did not increase as much in France as in neighboring countries.

The gold (or dollar) price of wheat in France was also low as compared with the gold price of wheat elsewhere. In the Paris market the dollar price per bushel of home grown wheat in December 1925 was only 2 per cent higher than the dollar price in 1913. In the same interval the dollar price of wheat had risen 31 per cent in Berlin. Comparisons with other countries are shown in the following table:

Country	*Ratio of the dollar price of a bushel of home grown wheat in December 1925 to the dollar price in December 1913*[6]
France (Paris)	102
Germany (Berlin)	131
England and Wales	169
United States (Chicago)	192
Argentina (Buenos Aires)	196

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[5] League of Nations, *Memorandum on Coal*, Volume I, p. 22.

[6] League of Nations, *Agricultural Problems in their International Aspect*. It is difficult to make international comparisons because wheat prices vary from country to country in accordance with different climates and soils. There was, however, so great a discrepancy between the rise in price in France and in other countries from 1913 to 1925 as to point to currency disturbances rather than natural conditions as the more probable cause for this difference.

As will be shown in the chapter on metallurgy, the prices of pig iron and merchant iron were much lower in terms of dollars in post-war France than in other countries.

In spite of the relative cheapness of commodities in France, the French market was far from being equally attractive to all foreign buyers. Up to this point, only the American buyer has been considered, as representative of all outsiders possessing a gold standard currency. The fact is, however, that there were practically no foreign buyers, with the exception of those of the United States, whose money had not at one time or another fallen more or less below gold parity during the post-war period. The great bulk of French exports was destined for countries which were also in the throes of inflation and monetary depreciation. The currencies of England, Holland and Switzerland were up to 1925 somewhat short of their pre-war dollar exchange value, but not as much as the franc. This meant that from the point of view of monetary exchange the advantage which these countries probably enjoyed in importing from France was not as great as that of the United States. On the other hand, Germany, Austria, Italy, Belgium and a number of other countries all had currencies which were at times — at least up to 1925 — even more depreciated than the franc. For them, consequently, France was a prohibitively expensive place to buy in during their inflation crises.

The French market suffered not only from a falling off in exports to these countries, but from the fact that greater depreciation in other countries proved to be a competitive peril to France. It frequently happened that prices and exchange in Germany, Austria, Belgium and Italy were such as to give a greater advantage in purchasing power to the dollar, the pound sterling, the Swiss franc or the Dutch guilder than was to be found in France. Then indeed holders of the relatively appreciated currencies, whenever they had the choice, would prefer to buy from Germany or Austria or Italy or Belgium rather than from France.

It is evident, therefore, that comparisons of French commodity and exchange values with those of the United States alone are very imperfect measures of the stimulus of inflation to French foreign trade. The value of the franc in terms of dollars is only a good index of its gold value, but it throws little or no light on the multifarious influences affecting the French export trade. Many foreign moneys other than the American dollar were exchanged for French goods in the post-war period — principally the moneys of England, Germany, Switzerland, Belgium and Italy. Any adequate analysis of the relation between inflation and total French exports requires a comparison of the exchange and commodity values of at least five or six countries with those of France. This has been done in the accompanying chart (Chart VI).[7] In this chart the sections of a curve that are found above the theoretic parity line indicate when and to what degree exports to the country concerned tended to be stimulated, while sections below the line indicate when such exports tended to be discouraged. The outstanding feature of the five curves in Chart VI is that each one is very different from the others. The German curve, for example, dips far below the theoretic parity line up to some time in 1923 when German stabilization set in. France was, thus, in the early years after the war, an excessively costly market for

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[7] The curves were constructed as follows: First the number of francs that could be bought by a unit of currency of a given country in each post-war month was divided by the number of francs which could have been bought with this unit of currency in 1913. Thus the monthly exchange ratio was determined for each country. Then the French wholesale price index number was divided by the corresponding wholesale price index number of the country compared for each post-war month. This gave an index of the rise of French prices relative to the rise in prices in the given country. Finally each monthly exchange ratio was divided by the corresponding monthly price index ratio; and the final quotient, if greater than unity, indicates the degree of advantageousness of the French market for the foreign money concerned, or if it is less than unity, the degree of disadvantage. Unity was subtracted from the final quotient in each case, and percentages were measured from the zero line which represents theoretic purchasing power parity, that is, the point at which a foreign currency would have the same purchasing power in France as at home.

In algebraic symbols: if E = exchange rate, or francs per unit of currency compared with francs; W = wholesale price index; Fr = France; x = any given country to be compared; and m = any given month, then

$$\frac{E_m}{E_{1913}} = E'.$$

In the month of m, $\frac{W_{Fr}}{W_x} = W'$.

$$\frac{E'}{W'} - 1 = \left\{\begin{array}{l}\text{Percentage difference between the actual purchasing power of the}\\ \text{currency of the country } x \text{ in France and the theoretic purchasing}\\ \text{power parity.}\end{array}\right.$$

For data of the six countries see *Bulletin de la Statistique Générale de la France.*

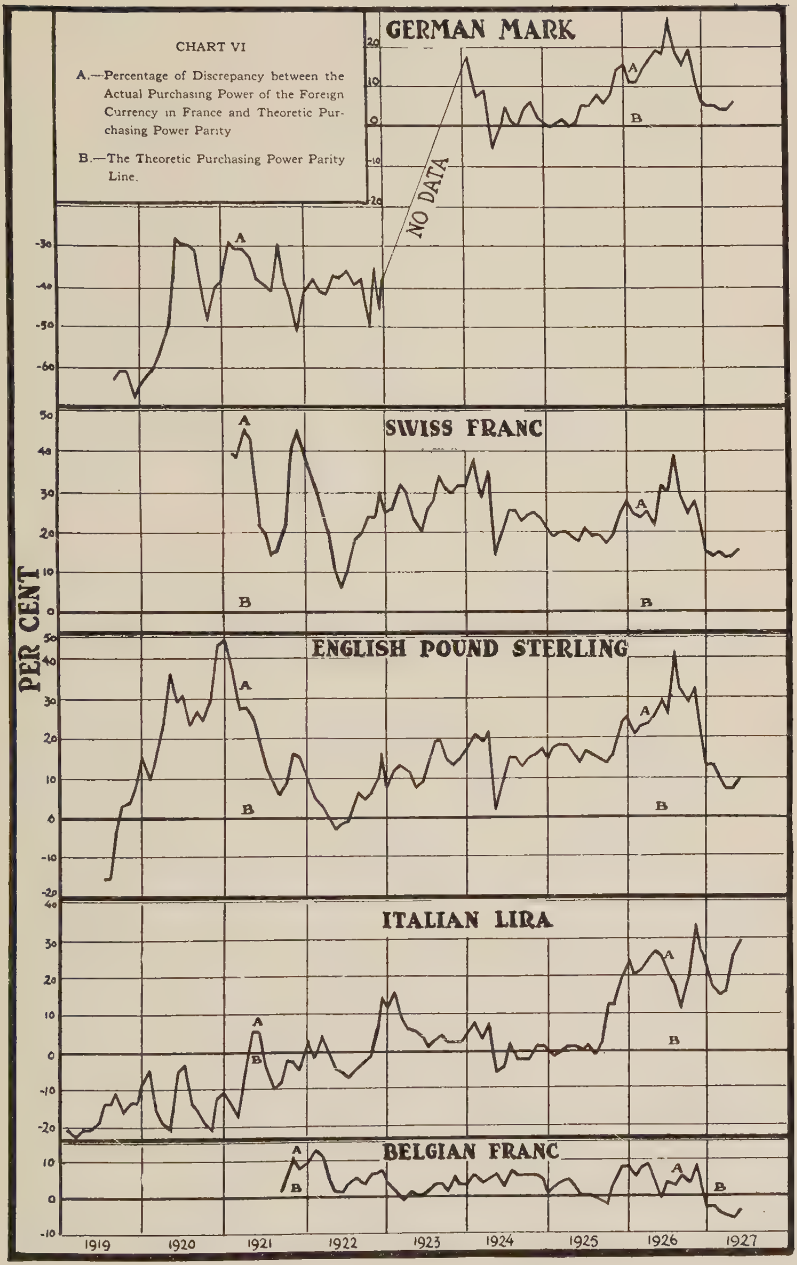

CHART VI

A.—Percentage of Discrepancy between the Actual Purchasing Power of the Foreign Currency in France and Theoretic Purchasing Power Parity

B.—The Theoretic Purchasing Power Parity Line.

GERMAN MARK

SWISS FRANC

ENGLISH POUND STERLING

ITALIAN LIRA

BELGIAN FRANC

holders of German marks. As the Italian curve indicates, during the greater part of the period from 1919 to 1923, Italy was — though to a much smaller degree — in a position not unlike that of Germany. Both were good places for the French to purchase in, and both were at a disadvantage in buying from France. Everything in the British and Swiss curves, on the other hand, points to a probable stimulation of exports from France to these countries throughout the post-war period. The Belgian curve, which hugs the theoretic parity line fairly closely, shows that the monetary exchange and price movements fluctuated in very much the same way in Belgium as in France, so that the trade between these two countries could hardly have been greatly affected in any direct way by inflation. It is clear, therefore, from the patent dissimularity of the five curves that inflation could stimulate French exports only in so far as the countries with which France traded had less monetary inflation than France.

The degree of stimulation to French exports as a whole depended upon whether or not foreign moneys on the *average* had a greater purchasing power in France than in their respective domestic markets.[8] By combining the five curves of the previous chart and the discrepancy curve in Chart IV, an average curve B was obtained which is given in the chart opposite (Chart VII).[9] The exports from France to the United States, Great Britain, Germany, Switzerland, Italy and Belgium constituted in 1925 about 63 per cent of the French total exports, and 73 per cent of all French exports except those to the colonies. In other words, the average discrepancy curve which represents the average exchange and price relationship between the above six countries and France, may be taken as fairly representative of the probable monetary influence which was exercised in one way or another on the total exports

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[8] Only the relation between monetary phenomena and exports is considered here. There were undoubtedly other factors affecting the volume of French exportation, such as fluctuations in the quality of French exported goods, changes in sales methods and sales organization abroad, and the general industrial and commercial development of other countries engaged in international trade.

[9] The data for constructing the average curve were computed by averaging the discrepancy data of the United States, England, Germany, Italy, Belgium, and Switzerland every month after weighting according to the relative importance of the export trade to each of these countries.

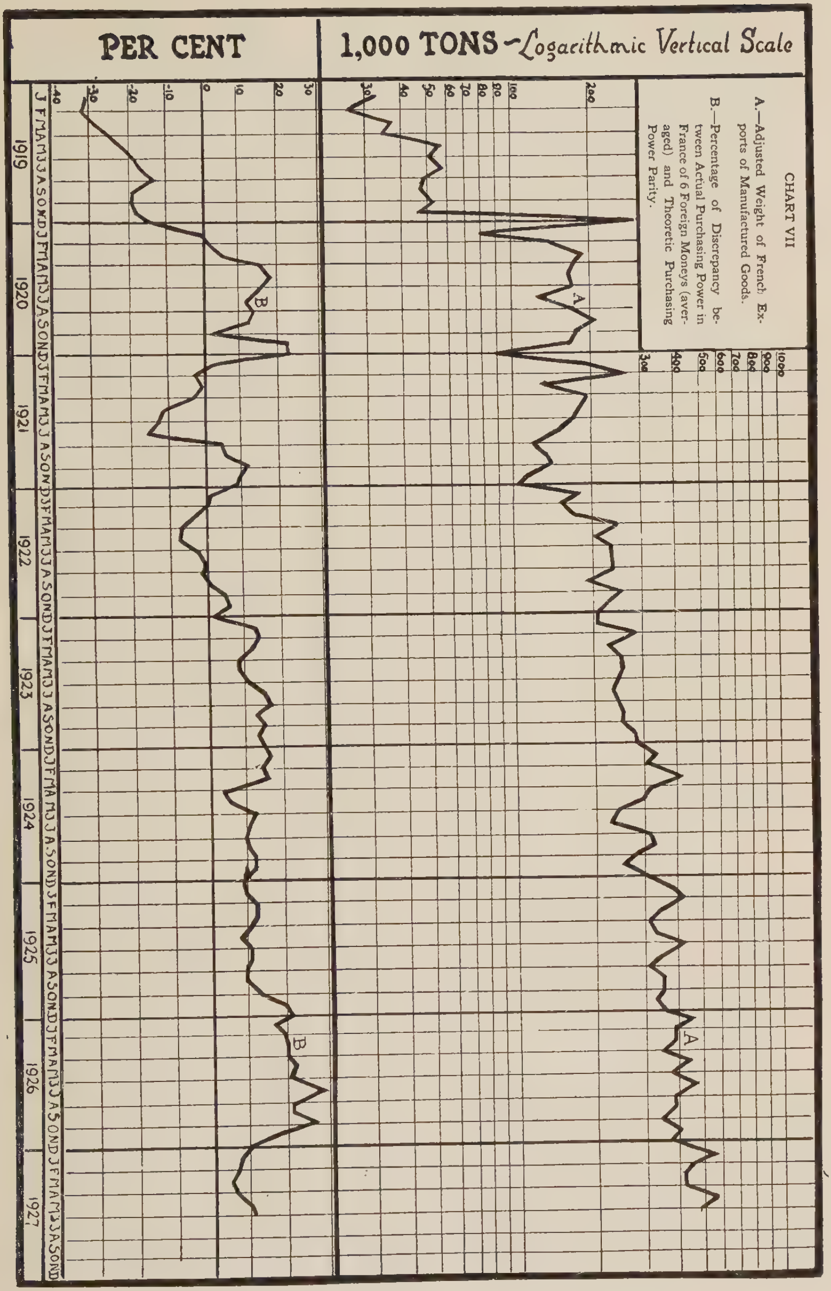

CHART VII

A.—Adjusted Weight of French Exports of Manufactured Goods.

B.—Percentage of Discrepancy between Actual Purchasing Power in France of 6 Foreign Moneys (averaged) and Theoretic Purchasing Power Parity.

of France. It must be borne in mind, however, that the price data used were average wholesale prices from which particular export prices may differ a great deal.

The prevailing position of the six-nation average curve above the theoretic parity line indicates that French exchange rates and French prices were such as to make France an attractive place for most foreign buyers during the greater part of the post-war period. Except for 1919, during part of which the value of the franc was artificially controlled, and except for several months in 1921 and 1922, as a result of the world-wide economic crisis, the price situation in France was undoubtedly favorable to expanding exports. Nevertheless, it is not so much the general position of the curve as the direction and rate of change from time to time that provide the principal stimulating or depressing influence on exports.

In this connection, the brusque slopes upward and downward in the first half of the average discrepancy curve must be interpreted with caution, for the six nations are not all represented in the average for the whole period. Up to June 1919 only the United States and Italy are accounted for; then British data become available after June of that year, and German data after August. Switzerland does not enter into the average until January of 1921 and Belgium comes in very tardily in August 1921. Then again, Germany falls out during all of 1923, because of the chaotic German monetary conditions in that year. Indeed the rise in the average curve over theoretic parity from August 1921 to the end of the year is probably unrepresentative, in view of the fact that it coincides with the adding in of Belgium shortly after Switzerland in the determination of the average.

When through the years 1924 and 1925 the discrepancy curve stood at an approximately unchanging distance above theoretic parity, it is doubtful whether any great stimulation was given to the export trade. Prices were, to be sure, favorable, but always to about the same extent and degree. The tendency under such circumstances would be for exports to become adjusted in a static sense to the new price situation. The steep upward slope of curve B in 1926 would lead one to anticipate a correlated expansion in the volume of exports, and the rapid decline at the close of 1926 and in 1927 would be expected to reduce exports.

That the actual movement of exports of manufactured goods did not fulfill these theoretical expectations is clearly evident from a comparison of curve A[10] with curve B in Chart VII. The movement of manufactured exports from month to month was highly irregular, characterized by many sharp changes and fluctuations, as is almost always the case with short period statistics of foreign trade. Occasionally, however, definitely correlated tendencies are discernible over several months. If allowance be made for a short lag between price changes and their probable effects on exports, then it is seen that there was a considerable recession in exports during 1921–1922 which is probably ascribable to the price depression of 1920–1921. With the economic revival and rise of prices of 1922–1923, exports, like production, resumed their upward course.

[10] Curve A represents the monthly movement of exports in weight smoothed to eliminate seasonal fluctuations. In general, the export trade was found to be a little heavier in the latter half of the year than in the first half and a little lighter in January than in other months. The seasonal fluctuations were determined roughly by computing the ratio of the export trade in manufactured goods each month to the average monthly export trade of the same category each year from 1922 to 1926 inclusive, and then by averaging the result of each month for the five years. The results of this computation were as follows:

MONTHS	1922	1923	1924	1925	1926	AVERAGE (1922–1926)
Jan.	.61	.59	.81	.76	.84	.72
Feb.	.74	1.14	1.02	1.16	.98	1.01
Mar.	.73	.86	1.34	.97	.94	.97
Apr.	1.08	.92	.97	.80	.82	.92
May	.73	.79	.78	.75	.86	.78
June	.98	.86	.72	1.03	.84	.89
July	1.16	.97	.80	1.03	1.25	1.04
Aug.	1.32	1.15	1.22	1.05	1.15	1.18
Sept.	.95	1.07	1.18	1.07	1.04	1.06
Oct.	1.32	1.08	1.02	1.09	.94	1.09
Nov.	1.13	1.13	.88	1.00	1.09	1.05
Dec.	1.20	1.40	1.21	1.25	1.18	1.25

Finally, the seasonal corrections were made by dividing the quantitative export figures of each month by the average ratios of the corresponding month.

About the middle of 1923 there was a slight decline again which corresponded, after due allowance for lag, with the occupation of the Ruhr. Again in 1924, when the exchange rate of the franc was suddenly forced up with the aid of the Morgan loan (corresponding with the dip in curve B in April and May of 1924), there was also a certain diminution in the volume of manufactured goods exported. That is all the definite concordance there really is between the two curves, for while at the end of 1925 and in the first half of 1926 curve B gives unmistakable evidence of an important price stimulation to exports, the upward movement of curve A gives no sign of particular acceleration through the whole of 1926.

There are many reasons which may account for the want of harmony between the two curves. It may be explained, in part at least, simply by errors inherent in the data on which the curves have been constructed. For example, the fact that export prices are not always the same as general internal wholesale prices throws a certain suspicion on the adequacy of curve B as representing the price stimulus to exports, since that curve is based exclusively on internal wholesale price data. This inaccuracy is probably small, since, as it has been seen, the Federal Reserve index of the price of French exports differed only slightly from the wholesale price index of the *Statistique Générale*. The burden of error, in so far as error may be responsible for the lack of parallelism, lies very probably with curve A, since the category, all manufactured goods, is perhaps too large for measuring refined movements in exports. In this total are included important month-to-month shifts due simply to changes in the kind of articles exported — from more to less bulky articles or vice versa. A significant element of error in curve A arises from the fact that actual exports of a given month are very frequently not inscribed in the statistics of exports until one or two or even three months later. Moreover, part of the zig-zag irregularity of the export curve has nothing to do with inflation but is only the result of the unequal length of months.

Another probable cause of the absence of any constant relationship between curves A and B is the existence of a great many factors affecting exports not directly connected with fluctuations in money and prices. In the first place, as has already been observed, foreign trade is perhaps as much a function of domestic trade as of price movements. Indeed it is highly probable that the level of prices of exported goods was influenced by the degree of activity of the domestic market. Moreover, the constant change and confusion in the tariff situation of post-war Europe and the new commercial treaties negotiated by France with other countries undoubtedly affected the volume of French exports of manufactured goods.

Nor should it be forgotten that the ability of other countries to buy was as important a determining factor as the ability of France to sell cheaply. Countries exhausted by wars and currency disturbances found their capacity to purchase abroad, even under very favorable conditions, severely limited; and this fact had a depressing influence on French exports, which counteracted the stimulating effects of the depreciation of the French currency. The capacity of other countries to buy in France was often contingent on foreign loans, and these loans were, to be sure, not timed with currency depreciation in France.

There was still another disturbing factor which prevented the volume of exports from responding always to exchange and price contingencies. Not only were foreign buyers often restricted in their capacity to buy, but French sellers were often limited in their capacity to sell, because production was, by the very nature of things, not elastic enough to expand and contract as rapidly as price conditions were changing in the course of inflation. Concretely, factories could not be built, machinery could not be installed, and raw materials could not be procured and transformed with the speed that the printing presses of the *Banque de France* were turning out new bank notes. And even if it were physically possible for manufacturers to increase their productive capacity in response to the precipitous growth of foreign demand, they would hesitate to do so for fear of being caught with a ruinous superfluity of plant equipment once the inflation crisis had passed.

When all allowances are made for errors and disturbing factors, it still appears unmistakably from curve B that France was from the end of 1922 to 1927 a favorable place for foreigners to buy in, since the franc had fallen in terms of other currencies more than

French prices had risen in terms of price levels prevalent in other countries. Furthermore the general swing of curve A at that time was unequivocally upward. Nevertheless, it would be rash to imply without qualification a relationship of cause and effect between the phenomena represented by these two curves, for it was also true that during these years French industry was being rapidly restored and re-equipped. It might be argued therefore that the swelling volume of exports was due to the improvement in French industrial equipment.

2. Inflation and Import Trade

From the purely logical and theoretical point of view the effects of inflation on imports are exactly the reverse of the effects on exports. French holders of a depreciating franc, wishing to purchase in a country with a non-depreciated currency, have first to procure the stable money and then to buy the goods for importation into France. At the acute stages of inflation, the price of any stable currency in terms of the franc rises higher than the ratio of French wholesale commodity prices to the wholesale commodity prices of the country with a gold standard currency. Then it is unusually costly for France to import from such countries.

Such is the theory. What are the facts? The fluctuations in the price of imports taken as a whole and measured in terms of a constant purchasing power do not contradict the theory, as the following figures show:

Year	*Price per kilogram of French imports in francs of 1913 purchasing power*
1920	.194
1921	.160
1922	.143
1923	.142
1924	.145
1925	.169
1926	.187
1927	.174

From 1920 to 1922 there was a rapid drop, which is what one would expect *a priori* from the theory of the effects of deflation on the price of imports. The rise from 1924 to 1926 again confirms the theory. Nevertheless since all imports include too many disparate elements, it is safer for further analysis to divide imports into component categories, which are the same as they were for exports.

The price per unit of manufactured imports followed very much the same movement as the price of all imports:

Year	*Price per kilogram of manufactured imports in francs of 1913 purchasing power*
1920	1.025
1921	.906
1922	.747
1923	.710
1924	.706
1925	.788
1926	.791
1927	.820

The changes in price in the early years after the war were, however, less ascribable to monetary fluctuations than to other conditions. It was in these years that France borrowed abroad large sums which were often delivered in the form of manufactured merchandise. At that time, also, French industry was only in the process of being rehabilitated, and the nature of the manufactured goods imported changed a great deal from period to period, as the reconstruction of plant equipment made it less necessary to import certain articles. The effects of inflation on imports are better seen in the latter years, when other factors intervened much less in the interaction of currency disturbances on prices and purchases abroad.

The price per unit of imported materials for manufacture also fluctuated as the theory would lead one to anticipate:

Year	*Price per kilogram of imported industrial materials in francs of 1913 purchasing power*[11]
1920	.118
1921	.097
1922	.096
1923	.104
1924	.106
1925	.131
1926	.148
1927	.129

In terms of constant purchasing power the price fell during the period of deflation, 1920–1922, and rose again sharply in the second acute inflation period, 1925–1926, only to fall once more during the *de facto* stabilization of 1927.

Unlike the fluctuations in the price per unit of weight of manufactured imports and imported materials for industry, the year-to-year changes in the price of foodstuffs (principally agricultural products) in terms of constant purchasing power ran, in fact, contrary to the accepted theory:

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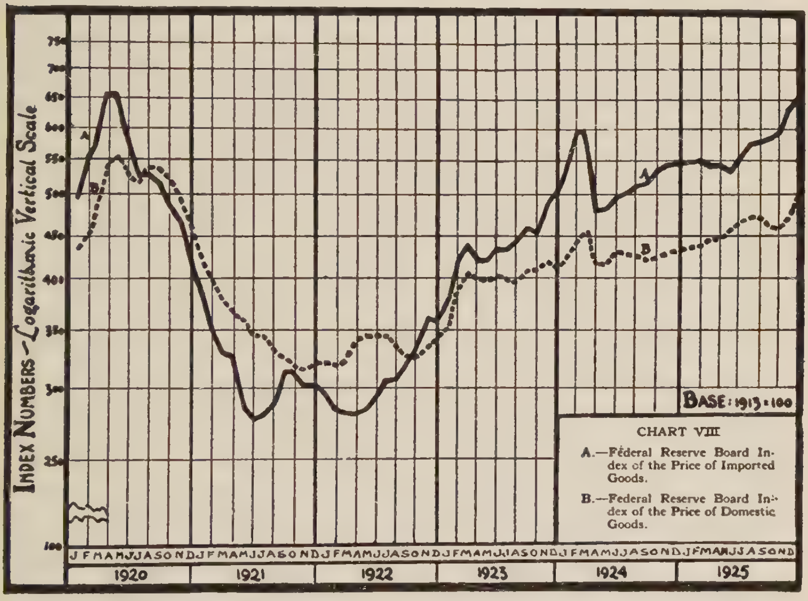
[11] The predominating element in imports of industrial materials is coal, and in view of the fact that it is extremely bulky it is bound to have a disproportionate influence on the price per unit of weight of such imports. Moreover the price of coal on the international market was greatly affected by the collapse of the mark, the occupation of the Ruhr, the British coal strikes, etc. Hence it is desirable to abstract coal from the other materials for manufacture in order to see how the price per unit of these latter commodities fluctuated:

Year	*Price per kilogram of imported industrial materials except coal, in francs of 1913 purchasing power*
1920	1.72
1921	.84
1922	.83
1923	1.08
1924	1.37
1925	1.79
1926	2.16

Even exclusive of coal, materials for manufacture were costing more and more per unit of weight as the franc depreciated in value.

Year	*Price per kilogram of imported foodstuffs in francs of 1913 purchasing power*
1920	.376
1921	.390
1922	.351
1923	.314
1924	.322
1925	.328
1926	.326
1927	.341

Thus prices actually rose from 1920 to 1921, hardly increased at all from 1924 to 1926, and rose again in 1927. Nevertheless these price movements can hardly be taken as invalidating the theory, since the international supply and demand in respect of agricultural products are as much a function of variable natural conditions as they are of monetary crises.



Another piece of evidence supporting the current theory of the influence of inflation on the price of imports may be found in a comparison of the Federal Reserve Board index of the price of imports and the price index of domestic goods. As the preceding diagram (Chart VIII) indicates, the price index of imported goods rose much higher than the index of domestic goods during the years of inflation, while in the period of falling prices and deflation it fell much lower.[12] It was thus relatively less advantageous for the French to buy in foreign markets than in the domestic market during inflation, and relatively more favorable for them to buy in foreign markets than at home during deflation. The probable reason why the price of imports apparently moves more in accordance with *a priori* conceptions than the price of exports,[13] is that the former is essentially a function of exchange rates, while the latter is also powerfully influenced by domestic trade and industrial conditions.

The data just considered relate to prices of imports during inflation and deflation, and these data correspond generally with the theory that during inflation the prices of imports rise and that during deflation they fall. A natural corollary would be that the volume of imports must diminish during inflation and increase during deflation. As to whether this actually happened is difficult to ascertain for reasons previously given in connection with the discussion of the influence of inflation on exports. One of the principal difficulties is the presence of numerous factors, other than French monetary disturbances, all affecting trade. Such were, for example, the chaotic currency conditions of other countries, the disorganization of world trade during the early post-war years, the frequent changes in tariff and commercial treaties, etc. Moreover the weight of all imports, composed of bulky objects of little value and minute objects of great value, is a rather imperfect measure of

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[12] See *Federal Reserve Board Bulletin.* The wholesale price index numbers of the *Statistique Générale de la France* reveal the same movement. The following figures were selected at the peaks of inflation and at the troughs of deflation:

	Wholesale Price Index (S. G. F.)	
Date	*Imported Products*	*National Products*
April 1920	706	540
June 1921	379	247
July 1926	1074	733
Dec. 1926	628	647

[13] See above pp. 129–131.

the volume of imports. The following figures are, therefore, of limited significance as an indication of concordance or lack of concordance with current theory:

Year	*Index numbers of the weight of all French imports* [14]
1913	100
1919	87
1920	114
1921	90
1922	116
1923	124
1924	128
1925	107
1926	102
1927	112

The movement in the volume of imports of manufactured goods offers a somewhat more refined measure than the above gross total of imports:

Year	*Index numbers of the weight of manufactured imports* [14]
1913	100
1919	118
1920	159
1921	102
1922	107
1923	95
1924	95
1925	81
1926	88
1927	74

In the early years after the war the quantity of manufactured goods imported was probably more affected by the needs resulting from the disrupted state of industry than by inflation or deflation.

[14] No adjustment was made for changes in territory within the customs boundary of France. Thus, the 1913 figure is based on pre-war territory, while the figures from 1919 on refer to exports into France including Alsace-Lorraine. In 1925, 1926 and 1927 the Saar was included also.

The general tendency from 1922 to 1926 was one of decline — which was to have been expected — but there was a slight increase in 1926 over 1925 when theoretically one would expect to find an important decrease in view of the acute inflation at that time. Moreover, in 1927, when the improved exchange conditions rendered foreign manufactures more available to the French than in the preceding year, there was nevertheless a sharp diminution in the weight of these imports.

Thus, on the whole, the harmony between the fluctuations in the volume of manufactured imports and the changes in the monetary situation was rather vague, hardly justifying the postulation of an intimate relationship of cause and effect between the two phenomena. The diminution in manufactured imports may as well have been due to industrial expansion based on increased resources and equipment, as to price and exchange conditions. Still another probable contributing cause of shrinkage in this category of imports was the loss of French foreign investments during the war. The capacity of France to purchase abroad was thus considerably curtailed. There are no data available to shed light on the relative importance of these causes, which probably all exercised a more or less predominating influence at different times.

The importation of materials necessary for manufacturing stood in a different relation to inflation than the importation of finished consumers' goods. It was more directly bound up with changes in the intensity of domestic production. In so far as inflation stimulated industrial activity, it obviously stimulated at the same time the importation of industrial materials; but inflation also discouraged such imports because of the high prices which prevailed during the critical periods. Consequently fluctuations in the volume of imports of these materials were resultants of the conflicting forces both produced by inflation. This lends all the more interest to the following column of figures (see next page).

The period 1920–1921 was not only a period of deflation, operating to make imports less expensive, but it was also a period of business depression, tending to discourage both production and the purchase of raw and semi-manufactured materials. The weight

Year	*Index numbers of the weight of imports of industrial materials* [15]
1913	100
1919	80
1920	113
1921	92
1922	120
1923	128
1924	133
1925	110
1926	105
1927	112

of imports, therefore, declined. From 1922 on prices rose, and encouraged business and industrial activity. Thus, in spite of the fact that from 1922 to 1924 the gold value of the franc fell, making imports expensive and tending to discourage them, the volume of imports of materials necessary for manufacture expanded. From these indications inflation may be interpreted as generally stimulating the importation of raw materials indirectly through the encouragement given to the production of manufactured goods. This stimulus apparently more than offset the reverse influence of rising prices of imports during inflation.

The interpretation of the index numbers of the weight of imports of industrial materials from 1925 to 1927 is difficult because of the inclusion of the Saar within the customs boundary of France at that time. Previously to 1925, the Saar had been exporting into France large quantities of coal which were accounted for in the foreign trade statistics of French imports of materials for manufacture. After January 10, 1925, the item of coal imports from the Saar was no longer included in these statistics, and this fact consequently led to a brusque drop which can be observed in comparing the above 1924 and 1925 index numbers. By subtracting coal from the weight of imported industrial materials, the element of error arising from the shifting customs frontiers is largely eliminated. While there was still a decline from 1924 to 1925 in the following index numbers, it is much smaller than those previously noted, and instead of diminishing from 1925 to 1926 the volume of the imports increased:

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[15] See above, p. 147, note 14.

Year	*Index numbers of the weight of imported industrial materials except coal*[16]
1913	100
1919	53
1920	82
1921	77
1922	110
1923	119
1924	132
1925	115
1926	118
1927	118

These facts are not out of harmony with the theory of the influence of inflation, but they might also be the result of France's acquisition of new industrial resources.

3. The Crisis of 1925–1926 and Foreign Trade

The most clear cut manifestation of inflation in post-war France took place in the latter part of 1925 and the first half of 1926. This period is all the more significant from the point of view of a study of the influence of currency disturbances on trade because there was at that time a great attenuation of the disturbing factors. Monetary conditions in other countries were being stabilized; tariff schedules were becoming more settled; and the effects of war-time destruction on industry had largely disappeared. Moreover, this inflation crisis was set off in sharp relief since it was followed after July 1926 by rapid deflation and stabilization. In other words the causal nexus between the correlative monetary and trade phenomena is likely to be less equivocal than for the preceding years.

Curve B in Chart VII (page 137) indicates clearly how the attractiveness of the French market to foreign buyers, from the point of view of price, increased from September 1925 up to the autumn of 1926. When deflation and stabilization set in, the discrepancy curve swooped downward — but still remained above the theoretic parity line. Curve A, which represents the weight of manufactured exports, does not reveal any definitely parallel upward and downward movement during this period. What is even more surprising is that, although there was a diminution in the monthly quantity of these exports from July to November 1926 (quantities corrected to eliminate seasonal variations), from December 1926 through June 1927 these quantities definitely increased, in spite of deflation and stabilization and notwithstanding the downward drop of curve B which would lead one to look for a similar drop in curve A.

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[16] See above, p. 147, note 14.

The high level of exports of manufactured goods during deflation may be partly explained by the time lag in filling orders and also by the fact that the French customs authorities often inscribe the exports of a given month in the statistics of later months. But these lags probably do not tell the whole story. There are several other considerations which relate to the question — such as buyers' psychology, for example. In the critical period of 1925–1926, buyers were naturally in a state of great uncertainty as to the future of the franc. In view of anticipated further falls of the franc they hesitated to buy. When, on the contrary, the franc began to increase in gold value at the close of 1926 and capital flowed back into France, occasioning further rises in the franc, the buyers rushed to place their large orders for fear that the franc would go up still more if they waited. Then also, as was previously observed, during the inflation crisis the French consumer in his flight from the franc drugged himself with goods, and when the crisis was over the French manufacturer had to look abroad for markets.

The evidence at hand fits in with the statement often made that international trade thrives on stable conditions. Shifting tariffs and changing commercial treaties are notoriously bad for commerce. Undoubtedly stabilized foreign exchange rates are more advantageous for foreign trade than the ups and downs of a vacillating currency.

The fact that curve B (Chart VII, page 137) was still maintained above the theoretic purchasing power parity line, even in the course of the deflation process at the close of 1926, may also explain the relatively large volume of exports at a time when a rapid diminution would be expected. French prices remained apparently lower than the current world prices, even after the franc had practically doubled in gold value from July 1926 to January 1927. The French market continued to be attractive to foreign buyers under the régime of the *de facto* stabilization, with the additional advantage that no longer were unpleasant surprises about monetary disturbances to be feared.

The importation of industrial materials is no less interesting to examine in the 1925–1927 period than the exportation of manufactured goods. While the latter often ran contrary to the course that mere price considerations would determine, the volume of imports of industrial materials appears to be much more under the sway of the diminishing exchange value of the franc. The month-to-month fluctuations from January 1925 to June 1927 (with seasonal variations eliminated)[17] are shown in the following diagram (Chart IX). While there was a drop in these imports which corresponded roughly with the rising cost of foreign moneys in terms of the franc, it will be observed that this drop was neither of the ampli-

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[17] The method of computation used for smoothing curve A in order to eliminate seasonal fluctuations was the same as that described above, page 139, note 10. The following table gives the monthly weights by which the quantitative import figures of each corresponding month were divided. These weights are based on the 1920–1926 average of the ratios of the weight of imports of industrial materials each month to the average monthly imports of the corresponding year.

January	.90
February	.93
March	.97
April	.95
May	.97
June	.98
July	.99
August	1.00
September	1.08
October	1.02
November	1.05
December	1.17

tude nor of the regularity of the fall in the gold value of the franc. French currency was at its peak for this period in January 1925 and at its trough in July 1926. In that short interval it had depreciated in terms of gold by more than 50 per cent. The imports of industrial materials had reached their highest point for the years 1925–1926 in October 1925 and their lowest point in November 1926. The extent of the contraction was only 31 per cent. Moreover when foreign moneys became cheaper towards the end of 1926, the imports diminished. How this apparently paradoxical movement of imports may be explained will be pointed out presently.

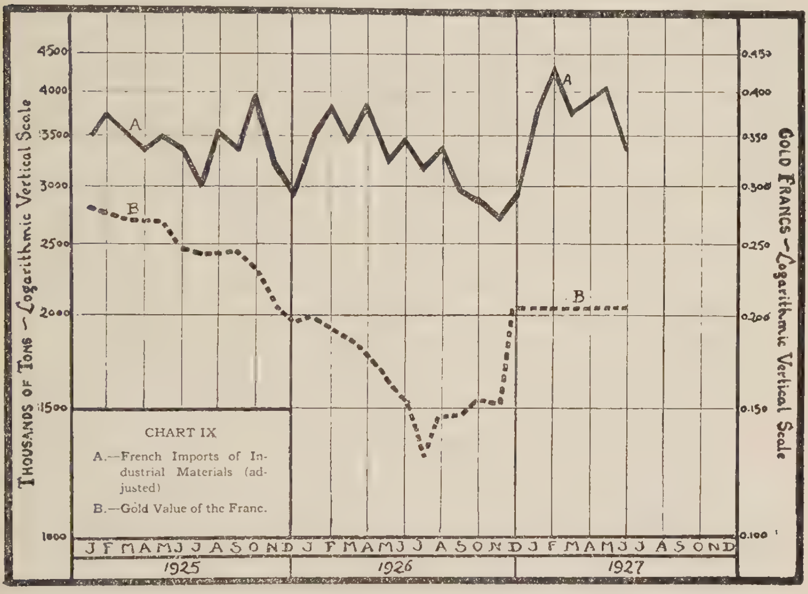

CHART IX

A.—French Imports of Industrial Materials (adjusted)

B.—Gold Value of the Franc.

The changing ratio of exports to imports reveals yet another aspect of the influence on trade of the acute inflation and deflation of 1925–1927. In the period previous to these years too many considerations extraneous to price dominated the movement of foreign commerce to permit one to attribute any changes in the export-import ratio to monetary fluctuations. For example the excess of the value of imports to exports in the early years after the war was simply due to the exhausted state of France at that time and to the destruction of plant equipment rather than to foreign exchange phenomena. Gradually, as the industrial war wounds were healed, the relative importance of imports in foreign trade yielded to exports, so that in 1924 and 1925 exports exceeded imports and in 1926 they were about equal in value. Thus the annual fluctuations in the ratio of exports to imports were as much the result of the process of industrial restoration and development as of the erratic movement of money and prices at that time.

From 1925 on, when the factories of France were practically all rehabilitated, the normal price motive came more to the fore. The monthly movement of the ratio of exports to imports given in the following table may therefore be considered as more closely related to inflation and deflation than the annual ratios from 1919 to 1926:

RATIO OF THE VALUE OF EXPORTS TO THE VALUE OF IMPORTS

Month	*1925*	*1926*
January	113%	88%
February	108	84
March	113	97
April	115	87
May	125	102
June	110	90
July	108	105
August	94	106
September	103	110
October	99	121
November	136	107
December	51	105

At the close of 1925 and during the early months of 1926, a period of progressive inflation, there was, contrary to theoretical expectations, an excess of imports. During the latter half of 1925, when deflation was most marked, there was an excess of exports, which is again contrary to theory. These contradictions, however, do not necessarily mean that the export-import ratios were not influenced by inflation and deflation. It was, in reality, inflation which in the early part of 1926 caused merchants and manufacturers to accumulate stocks, especially of imported raw materials, in anticipation of a further drop in the value of the franc. This, of course, lowered the ratio. Then, in the autumn and winter of 1926, merchants and manufacturers imported no more, but consumed their stocks while waiting for the franc to rise still more and thus make imports cheaper. This caused the ratio to rise at the close of the year.

In general, the available data of French inflation and trade point to a probable but none too well defined relation between the two phenomena. This relationship was by no means constant and it often manifested itself in contradictory ways which demand interpretation. Nevertheless one cannot escape the fact that both domestic and foreign trade were greatly affected by currency disturbances. That the effects were not always in accordance with the postulates of current theory may be due to the inadequacy of such theory as well as to imperfections in data and statistical methods. Yet the frequency of unexpected movements in foreign trade statistics casts suspicion on the practice of regarding the post-war commerce of France solely as a function of money and price conditions. There was such a multitude of other determining factors of at least equal importance — such as tariff barriers to foreign trade, the incapacity of many buyers to take advantage of low prices, and the limitations of physical production.

The admission of the last mentioned factor — the limitation of physical production as an influence affecting trade — reverses the assumption made at the beginning of this chapter, namely, that inflation affects industry *via* trade. In fact, inflation affects trade *via* industry as well, and thus it is difficult to analyze the effects of inflation on trade without at the same time investigating how French industry itself reacted to the currency disturbances of the post-war period.

CHAPTER VII

SOME EFFECTS OF INFLATION ON PRODUCTION

THE development of industrial production in post-war France has already been examined in detail.[1] It remains now to determine in what manner and to what extent this development was influenced by the ebb and flow of price movements in periods of inflation and deflation. Thanks to M. Dessirier's composite index of production it is possible to trace the monthly course of industrial and mineral output succinctly and with fair accuracy. The curve based on these index numbers is plotted again in the diagram opposite (Chart X), and with it are the curves of the wholesale price index and of the percentage of discrepancy between prices prevalent abroad (average of six nations [2]) and the internal prices of France.

For the most part production follows roughly the movements of inflation and deflation in their most pronounced periods, that is to say, production increases as wholesale prices increase and as the discrepancy in favor of foreign buyers widens, and it decreases as wholesale prices fall and as foreign buyers find less advantage in importing from France. Nevertheless a closer scrutiny of these curves reveals certain anomalies. For example, production started on its rapid upward course in September 1921, about six months before wholesale prices began to rise at all, and about a year before the purchasing power discrepancy showed any steady tendency to widen in favor of foreign moneys. What was true of trade, therefore, is apparently true of production also: there must be other intervening factors determining the volume of industrial output besides money and price conditions. The crippled state of French industry immediately on the close of hostilities prevented production from reacting fully to the inflation stimulus of 1919–1920. And the sudden bound in production at the close of 1921, for which no reason can be found in the movement of prices or foreign ex-

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[1] See above, Chap. V.

[2] See above, p. 136, note 9.

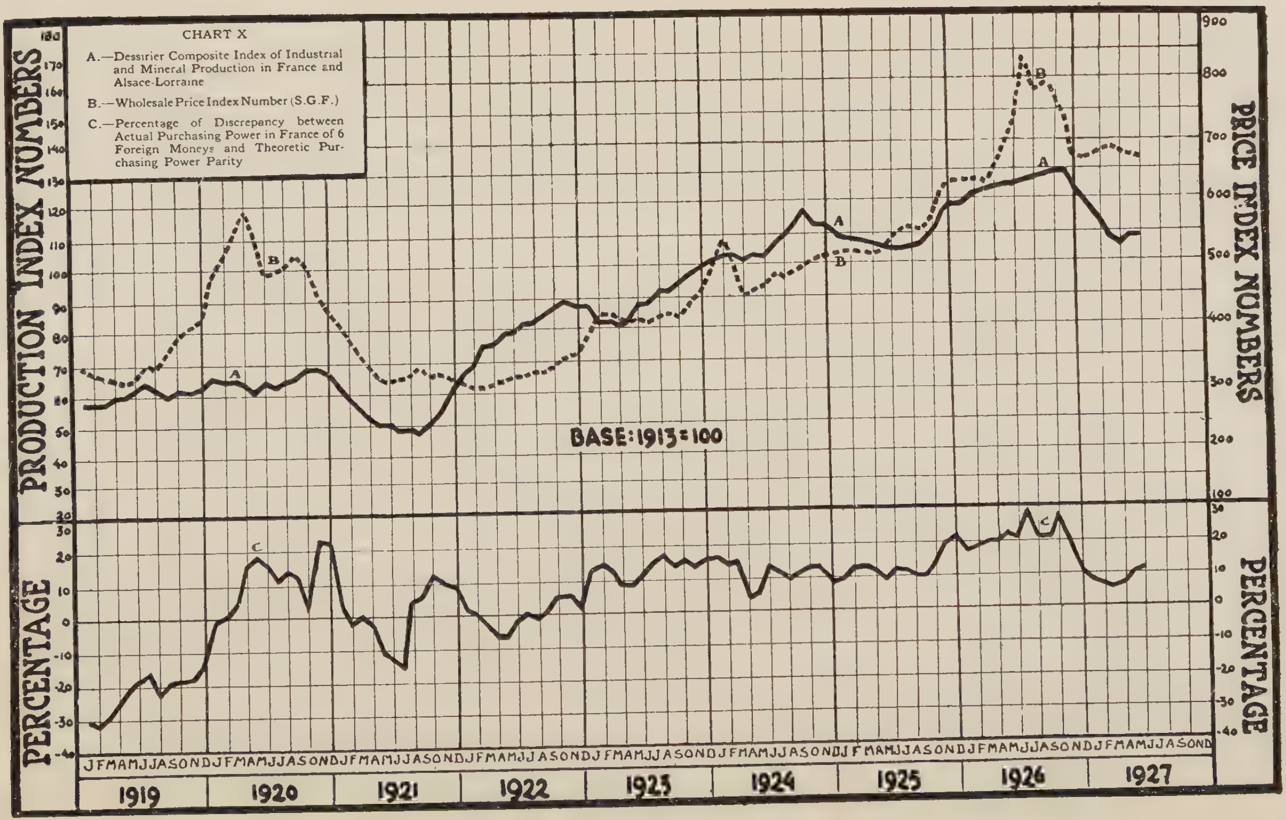


CHART X

A.—Dessirier Composite Index of Industrial and Mineral Production in France and Alsace-Lorraine
B.—Wholesale Price Index Number (S.G.F.)
C.—Percentage of Discrepancy between Actual Purchasing Power in France of 6 Foreign Moneys and Theoretic Purchasing Power Parity
PRODUCTION INDEX NUMBERS
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
PRICE INDEX NUMBERS
900
800
700
600
500
400
300
200
100
PERCENTAGE
30
20
10
0
-10
-20
-30
-40
BASE: 1913 = 100
A
B
C
J F M A M J J A S O N D
1919
1920
1921
1922
1923
1924
1925
1926
1927

change, was probably due, as has been previously pointed out, to the fact that the rehabilitation of a great many industrial plants in the north had just been completed at that time.

These are not the only inconsistencies in the relative movement of the three curves. During 1922 the production curve, the wholesale price curve and the discrepancy curve all rose together, but the production curve preceded the other two and the amplitude of its movement was much greater. In 1923 production continued to expand, and wholesale prices rose too, but the purchasing power of foreign moneys in France acquired very little in the way of new advantages. The dip in the production curve during the early months of 1923 is interesting not only as a consequence of the invasion of the Ruhr, but because it preceded the dip in the wholesale price curve. The cessation of deliveries of Ruhr coal, rather than price conditions, was obviously the determining factor.

The fluctuations in production and prices during 1924 and 1925 again run counter to *a priori* expectations. After brusquely leaping upward to a peak in February 1924, prices, the gold value of the franc, the discrepancy in favor of foreign moneys, all fell sharply and rose very little during the second half of 1924. In spite of the absence of any price stimulation either at home or abroad, production continued on its expanding course. Again in 1925 there was a great dissimilarity between the movement of production and that of inflated prices. In fact, they ran in fairly opposite directions, for production actually declined while prices and the purchasing power of foreign moneys in France both rose.

When really acute inflation set in at the close of 1925 and in the first half of 1926, then production did react and expand in a way that indicated the direct stimulus of rising prices and swelling exports. Industrial production reacted unmistakably also to the deflation which followed in the autumn of 1926. After a few months' lag, during which factories were still busy filling orders contracted in the inflation months, production fell along with prices through the spring of 1927.

Inflation and deflation were thus among the many influences that played a part in the post-war development of production. This is clear from the diagram opposite (Chart XI) showing the

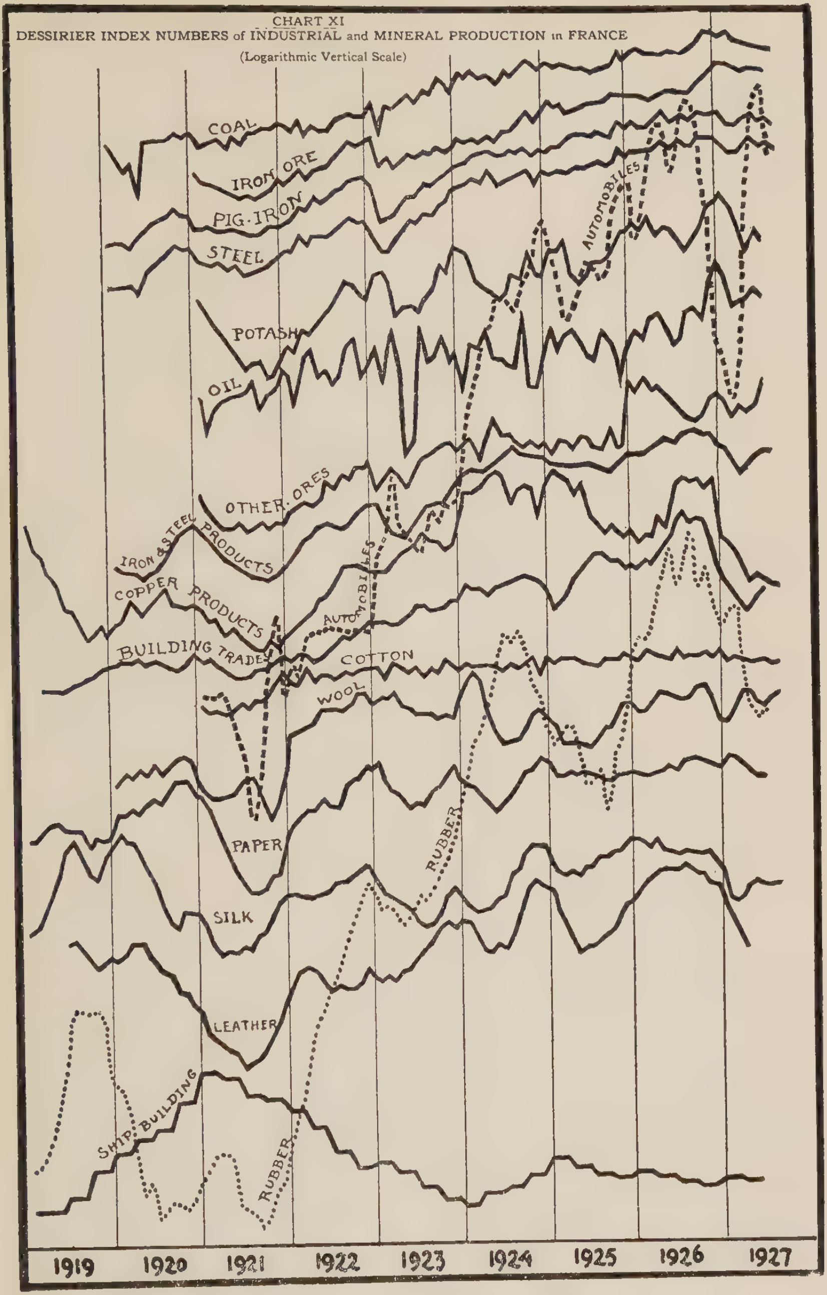


CHART XI

DESSIRIER INDEX NUMBERS of INDUSTRIAL and MINERAL PRODUCTION in FRANCE

(Logarithmic Vertical Scale)

course of 18 different lines of industrial and mineral production. While each curve has an individuality of its own and fluctuates according to the special conditions affecting the particular industry involved, nevertheless they all bow to common influences, particularly at periods of acute money and price disturbances.

1. Inflation and Costs of Production

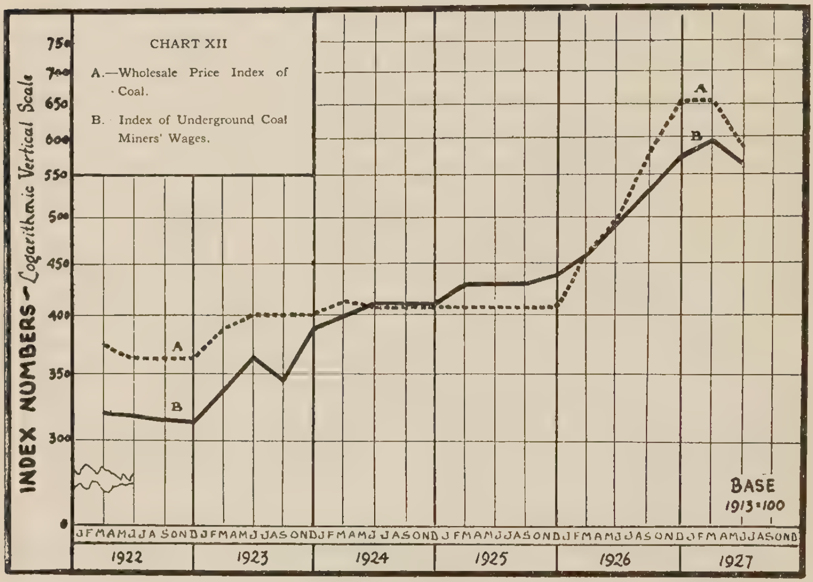
It was mainly through its effects on the cost of production that inflation exerted a direct influence on industrial output. This is fairly obvious in the case of that element of cost which consists of interest paid on capital charges. An industrial firm which had issued a million francs' worth of bonds before the war at the current rate of three and a half per cent was still paying 35,000 francs per year in 1926 as interest. In that year, however, these 35,000 francs were worth only 5,000 francs in terms of 1913 purchasing power. From the point of view of prevailing prices in 1926, therefore, the rate of interest on this loan fell from three and a half per cent to one half of one per cent. To be sure, not all the interest paid by industrial firms in post-war years related to loans contracted before 1914. There were bonds issued after the war too, but, with each decline in the purchasing power of the franc after the date of issue of the bonds, the rate of interest in terms of constant purchasing power fell, and this represented a saving in the cost of production. Such economies enabled business to sell at lower prices and stimulated production and sales.

There was, however, another and less brilliant side to this apparently advantageous contingency. What the borrowing industrial firms gained was lost to the lenders, who soon became wary and ceased to lend unless a more attractive return was offered. In the course of inflation crises, this led to the scarcity of capital and to the high cost of borrowing which were subjects of discussion in Chapter IV. It was seen that the interest rate increased as the depreciation of the franc continued. At the same time the uneasiness on the part of investors as to the currency situation and as to the immediate future of business made them hesitate to relinquish their capital for any length of time. Industry in order to expand definitely needs long-term loans for fixed capital investments; but just when expansion seemed most desirable, money was not available for more than exceedingly short periods. Moreover, when the gold value of the franc tumbled, vast sums — thirty-five billion francs, it is estimated — surreptitiously left France to find a presumably safer haven in foreign lands.

Thus the gain which accrued to industry in the reduced interest charges on old debts was offset somewhat by the difficulty of contracting new loans. Nevertheless, the older industries profited by inflation, for the interest on pre-war debts was reduced by about six-sevenths of its pre-war purchasing power value in 1926, while the cost of borrowing new capital probably did not more than triple. The new branches of manufacture, on the other hand, suffered. The electrical industry, for example, which demanded an especially heavy outlay of fresh capital for its development, was definitely retarded in its progress, because sufficient capital was not available. It is difficult to determine exactly, in view of these conflicting tendencies, whether French industry on the whole profited or lost by the effects of inflation on interest charges, but it seems very probable that there was a gain in the more accentuated phases of inflation, because of the magnitude of the reduction in this element of the cost of production.

Another important item in costs consists of labor charges. These were affected in post-war France not only by the depreciation of the currency, but by changes in the length of the working day, by increases and decreases in labor productivity, by strikes, etc. How this complex of varied influences altered labor costs, it is not possible to describe, in view of the incommensurability of the several elements. The effect of inflation on labor charges, however, may be determined by comparing the increase in wages with the increase in prices. Obviously, if wages increase exactly in proportion to the price of the products of labor, then this item of costs remains practically stationary. It is when wages do not keep pace with the upward price movement in times of inflation that any economy in costs of production results.

The most complete series of published wage rates in France are those of the coal miners. A comparison of the quarterly index of the average daily wages of underground workers for the whole of France with the wholesale price index of coal is made graphically in the following diagram (Chart XII).[3] It is clear that wages for the most part failed to increase to the same extent as the price of coal. Only from 1924 to the opening of 1926 did the two series of index numbers maintain themselves at about the same level. When the wage curve fell below the price curve, the mine operators very probably found that the labor item in their costs of production was relatively low.



Coal-mining, however important it may be, is only one branch of production, and the number of underground coal workers con-

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[3] Source: *Bulletin de la Statistique Générale de la France*, and League of Nations, *Memorandum on Coal*, Vol. I, p. 22. The price of coal is that of "Tout venant gras" at the mines in the Nord. Quarterly figures were available only after 1922. The following are the annual index numbers for 1920 and 1921:

Year	*Index numbers of miners' wages*	*Index numbers of coal prices*
1913	100	100
1920	350	775
1921	340	532

stituted (in 1921) only about 1.6 per cent of the total number of wage earners in France. It is necessary, therefore, to determine how representative the relative movement of coal miners' wages with respect to coal prices was of the relative movement of all wages with respect to the wholesale price level of France. There are, however, no general quarterly wage indices. The best composite measure of wages available is that published annually since 1925 in the *Bulletin de la Statistique Générale*,[4] giving the average wage level in 37 different men's trades (including unskilled trades), as reported by the *Conseils de prud'hommes*. The great disadvantage of these data is that they are sporadic, representing only four monthly points (February 1921, October 1924, October 1925, and October 1926) on the curve of wages since the war. There is no way of telling how characteristic these four points may be of the whole post-war period. Such as they are, they are compared in the following table of figures with the general wholesale price level:

Date	Index of Average Wages in France (Base: 1911 = 100)	Wholesale Price Index, *Statistique Générale* (Base: 1911 = 100)
February 1921	411	387
October 1924	478	510
October 1925	502	586
October 1926	584	772

The higher level of the average wage index in comparison with the price index in February 1921 may be explained by the fact that this was a month of active deflation. It has been generally observed both in France and elsewhere that when wholesale prices fall brusquely, wages follow with a certain lag. In October 1924, when inflation was moderate, in October 1925 when the rising price movement was more pronounced, and in 1926 when the effects of the recent crisis were still felt, then the wage level was considerably below the wholesale price level. Since the prevailing tenor of the post-war period was one of rising prices, and since all available evidence points to a sluggishness in the wage movement to keep pace with the wholesale price movement in either its upward or downward course, it is probable that in respect of labor costs industry in post-war France profited generally by the monetary disorder.

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[4] See *B. S. G. F.*, January issues for 1925, 1926 and 1927.

The wages of unskilled labor rose higher than the general run of wages with respect to pre-war levels, but they too did not increase as much as wholesale prices:

Date	Index of Wages of Unskilled Labor in France (Base: 1911 = 100)	Wholesale Price Index *Statistique Générale* (Base: 1911 = 100)
February 1921	430	387
October 1924	504	510
October 1925	540	586
October 1926	612	772

Consequently employers of unskilled labor apparently did not profit by as great a reduction in their labor costs as did employers of skilled labor.

The conclusions which may be drawn from these figures are necessarily problematical. The evidence with regard to wages is not only sporadic but fragmentary, for it contains no indication of part-time wage rates, overtime remuneration, or bonuses. Nor is it possible to determine what part in the rise in wages was due to the depreciation of the franc, and what part was due to the general dearth of labor in post-war France. Naturally a condition of expanding industry accompanied by a stationary population would raise wages, even in the absence of monetary troubles, except in so far as recourse to immigrant labor relieved the scarcity. Nevertheless, in spite of all the forces tending to increase wages, and in spite of the uncertain nature of the data, it is clear that wages did not rise to the same extent as wholesale prices — and industry in times of inflation thus enjoyed relatively low labor cost as well as low interest.

Not all the elements of the cost of production were affected in the same favorable way. Some costs like that of raw materials and that of producers' goods rose even higher than the general level of prices of consumers' goods. This is seen in the chart on page 166 (Chart XIII), which indicates graphically the course of the Federal Reserve Board index numbers of the prices of three categories of commodities. Only during the deflation period of 1921–1922 did the curve of the price of consumers' goods (i.e. final products of industry) rise above the curves of the price of the materials and instruments of production.[5] All the rest of the time, as it appears from these index numbers, the costs which manufacturers had to incur for their raw materials and for their machinery were at a relatively higher level than the prices which they received for their products.

It will be observed also in the same chart that for the greater part of the post-war period raw materials were relatively more expensive than producers' goods. This is probably due to the fact that a very large proportion of raw materials necessary for French industry is imported, and that the prices of imported goods were higher than those of domestic goods except during 1921 and 1922.[6] The price of producers' goods had at times (in 1920 and in the rising price period of 1923) even risen above that of imported goods. Then the industries engaged in the manufacture of machinery, tools, etc., received their greatest stimulus from inflation.

It thus appears that it is not possible to arrive at any definite conclusions with regard to the general effects of inflation on costs of production. It has been seen that labor costs and interest charges were probably reduced by inflation. On the other hand raw materials were all the more expensive as monetary disturbances became more acute. The rapid development of post-war French industry and the expansion of the export market would seem to indicate that, on the whole, costs of production were rather compressed than increased by inflation.

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[5] See *Federal Reserve Board Bulletin.* The curve of consumers' goods is somewhat faulty as a basis of comparison, because not all the consumers' goods of which the prices are represented are manufactured products; indeed many of them are agricultural products.

[6] See above, pp. 142–146.

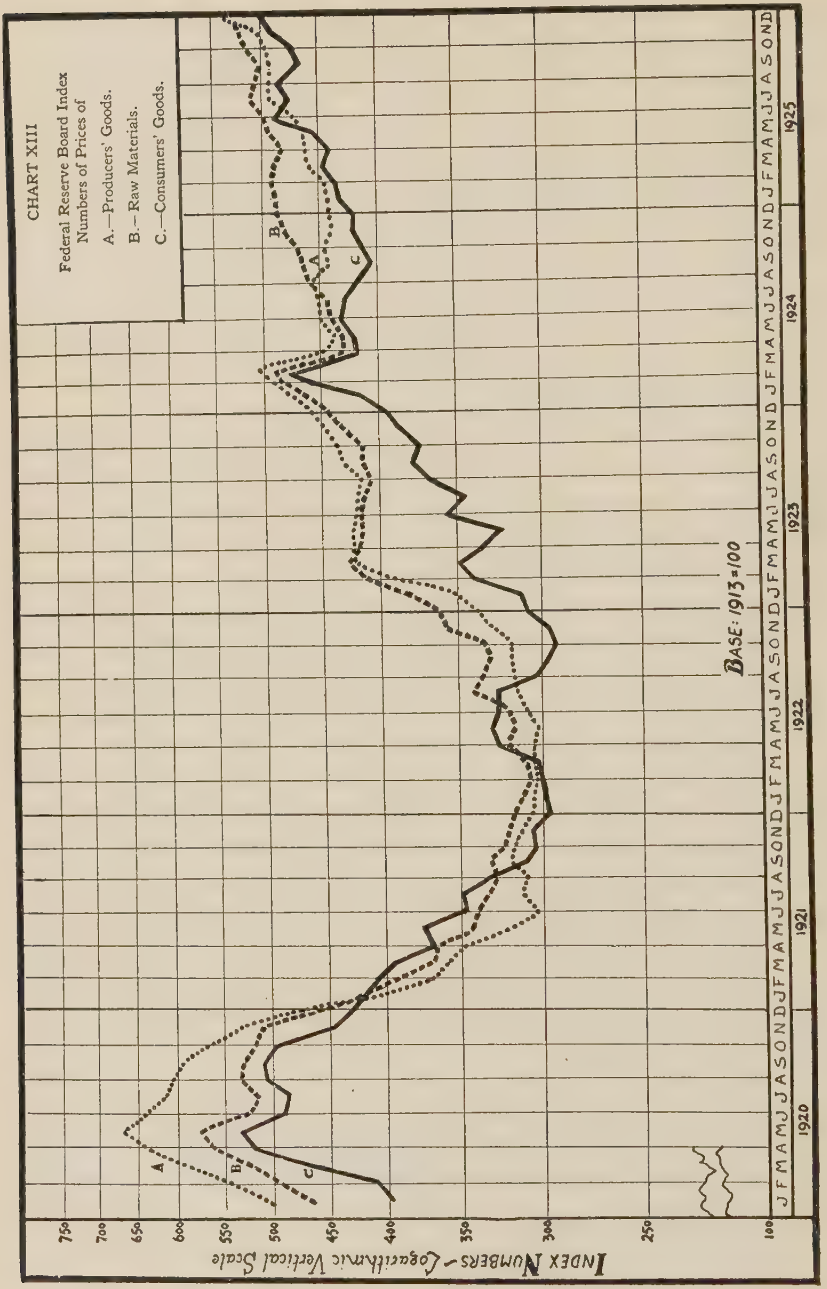
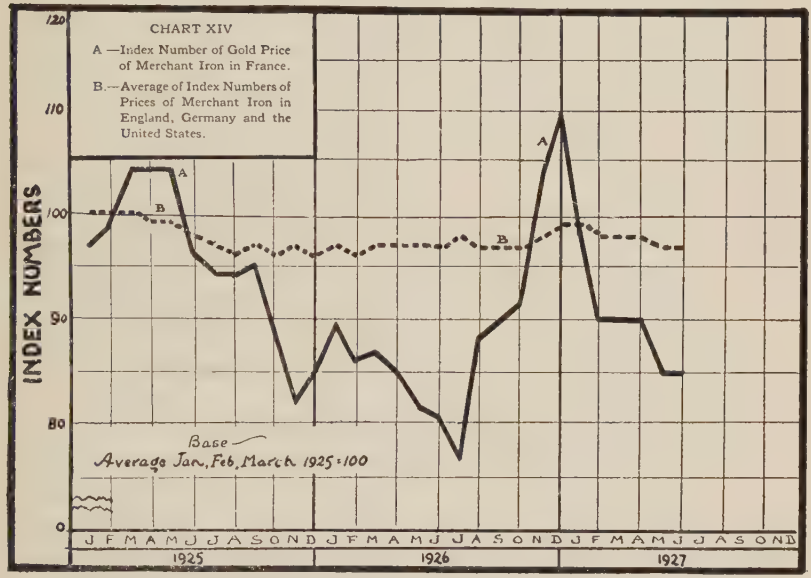


CHART XIII

Federal Reserve Board Index Numbers of Prices of

2. Illustrations from Selected Industries

The vagueness which characterizes the relation between inflation and industry in general becomes very much attenuated when particular industries are examined in periods of acute monetary disorder. The iron-bar industry lends itself to interesting analysis because of the fullness of the data. For example, the price of merchant iron during most of 1925 and in the first half of 1926 was lower in France than in England, Germany or the United States, as is seen in the chart below (Chart XIV).[7] Both the relative inferiority of prices of merchant iron in France during the months of inflation, and the rapid rise in the same gold prices, which had no counterpart in other countries, during the deflation months at the close of 1926, harmonize perfectly with the theory that inflation renders prices attractive on the international market, while deflation tends to reduce this attraction.



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[7] The index numbers plotted in curve A were based on the Paris quotation of "fer marchand au coke, 1$^{\text{ère}}$ classe," in francs per 100 kilograms, reduced to gold francs; while the index numbers of curve B were computed by simply averaging the index of the price quotations of merchant iron in Oberhausen, London and Philadelphia

The next step is to see whether the favorable price situation really did stimulate exportation. One would expect net exports to absorb an increasing part of total production during inflation and a diminishing part during deflation. Curiously enough, the facts, which are depicted in the following diagram (Chart XV), did not correspond with such expectations.[8] Curves A and C show a disconcerting parallelism, that is to say: when the price of French iron and steel was becoming more and more favorable to exportation, net exports of steel products formed a diminishing proportion of total production, and when the price became unfavorable, the portion of production that was exported increased.

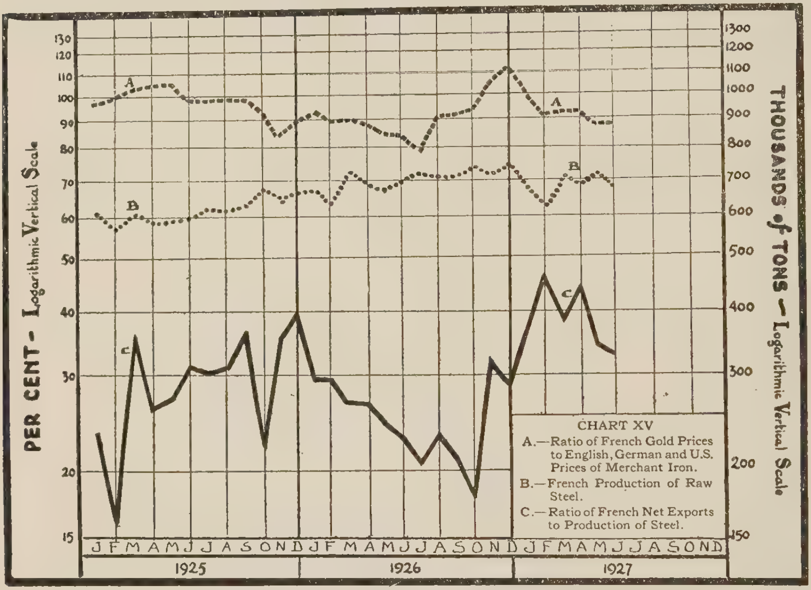

CHART XV
A.—Ratio of French Gold Prices to English, German and U.S. Prices of Merchant Iron.
B.—French Production of Raw Steel.
C.—Ratio of French Net Exports to Production of Steel.

How is this apparently unreasonable course of exports to be explained? If there were, in this two-and-a-half-year period, a lag of 6 or 9 months between price changes when orders were turned in and the final delivery of steel, then the paradox might be accounted for. Such, however, could hardly have been the case, in view of the fact that unfilled orders are great only when the steel market is active, and the steel market was far from active in the years in question. Undoubtedly there was a certain lag between the actual exports and the recording of them in the foreign trade statistics, but that delay is said to be spread over no more than three months. Another explanation more commonly offered is that buyers hesitated to make large orders while the franc was depreciating rapidly because they thought they might get the steel cheaper if they waited for a further fall of the franc. Likewise when the franc rose during deflation buyers hastened to place their orders before the franc rose still more. How great a rôle this buyers' psychology played it is impossible to determine.

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[8] The steel products included in the exports were: "1. fer et acier brut en lingots, 2. laminés ou forgés en blooms, billets et barres, 3. acier fin pour outils, 4. aciers spéciaux, 5. fer ou acier machines." Semi-manufactured products were selected because very few steel ingots are ever exported. For production data, see *Bulletin de la Statisque Générale de la France.*

The explanation which seems most plausible is one which may be derived from an examination of the complement of the ratio of exports to production. Obviously whenever the ratio of exports declined, the ratio of domestic consumption must have increased. These facts confirm the hypothesis formulated in the previous chapter that the volume of exports during inflation was more a function of the activity of the domestic market than of international price comparisons.[9] What could only be dimly suspected from the higher level of export prices as compared with domestic prices comes out in clear relief when it is seen that the volume of steel exports diminished both absolutely and relatively during inflation and increased during deflation.

The situation of the cotton industry was very much the same as that of the steel industry during 1925–1927. In spite of the absence of comparative price data, it may be safely assumed that during the months of inflation the gold prices of French cotton fabrics were inferior to prices in England, Germany and the United States. This was the fate of almost all French prices during inflation. It remains, therefore, to determine the course of production in France at that time, and to enquire how the proportion of production exported varied during inflation and deflation. This is done in the accompanying chart (Chart XVI), where curve A represents the estimated production of cotton fabrics (loom products)[10] while curve B represents the proportion of net exports of the principal loom products to production.[11]

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[9] See above, p. 131.

While production remained practically constant through the whole period considered, the part that was exported was apparently greater in the months of deflation than during inflation. This may be partly attributable to a lag in deliveries and to delays in recording export statistics, and it may be partly attributable also to buyers' psychology; but again, in view of the vastly increased proportion which the domestic market absorbed during inflation, the slump in exports at that time and the expansion in exports during months of deflation seem to be best explained as reactions to the changing intensity of home transactions.

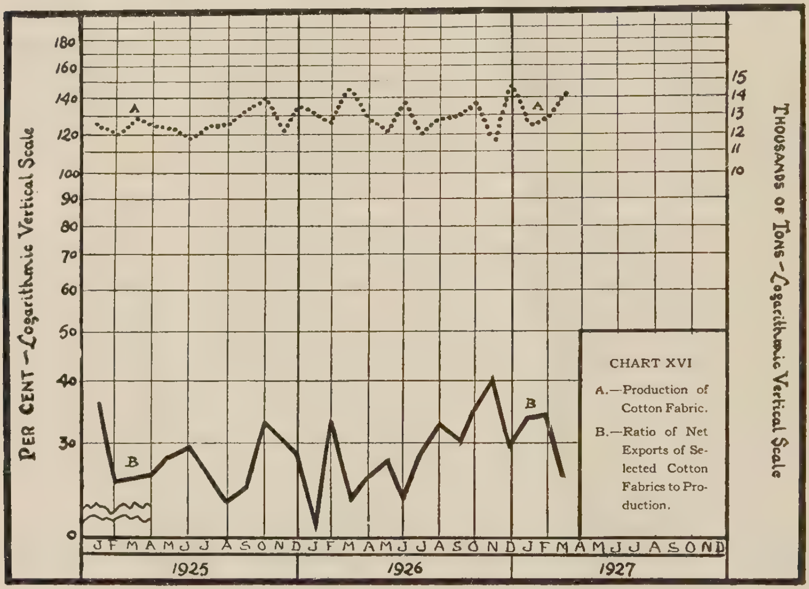

CHART XVI

A.—Production of Cotton Fabric.

B.—Ratio of Net Exports of Selected Cotton Fabrics to Production.

3. Inflation and the Domestic Market

To demonstrate adequately the hypothesis that fluctuations in the volume of exports in times of monetary disturbances are more directly dependent upon the expansion and contraction of the domestic market than on international price conditions, it would be necessary to place side by side monthly statistics of the whole domestic and foreign trade of France. This is impossible because anything like complete and comparative data bearing on domestic trade does not exist. Only vague and indirect indications are available showing the relative size of the domestic movement of goods. These indications, however uncertain and incomplete, are valuable from the point of view of any study of the effects of inflation on industry, because there can be no doubt but that the bulk of French production is destined for the home market.[12]

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[10] See *Stat. Mens. Com. Ext.* For method of calculating production data, see below, p. 362, note 37.

[11] The following foreign trade items of "tissus de coton" were included: "1. écrus, 2. blanchis, 3. teints, 4. fabriqués avec fils teints, 5. imprimés."

The monthly average of daily car loadings is of doubtful significance in France because of the extreme variety in the size of the cars. Moreover, the collection of these statistics was begun only in 1922. Likewise the quarterly figures of internal navigation ladings can in no way be taken as characteristic of the movement of domestic trade, because in periods of fluctuating prices, slow means of transport are avoided as much as possible, since losses accrue to buyer or seller if the goods change very much in value while in transit.

As regards the actual number of tons of freight carried by railways and internal waterways on the one hand, and the number of tons of merchandise exported on the other hand, only annual data exist. In the table on page 172 are shown the relative fluctuations of the two quantitative measures of trade in the post-war years.

During the inflation period from 1919 to 1920, exports increased much more than domestic traffic. In the deflation year from 1920 to 1921, there was an important diminution in the rate of increase of exports and a slight absolute shrinkage in the volume of internal freight. From 1921 to 1922, which was a period of revival, rising prices and slight depreciation of the franc, exports apparently profited more than internal trade. After 1923 the significance of the data is not at all clear. The practically stationary situation

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[12] In 1925 the freight carried on railroads and internal waterways alone in France amounted to 308 million tons which was more than ten times the weight of all exports that year.

Year	Percentage Fluctuation in Weight of French Exports	Percentage Fluctuation in French Railway and Internal Waterway Freight[13]
from 1919 to 1920	+ 131	+ 36
" 1920 " 1921	+ 25	− 4
" 1921 " 1922	+ 41	+ 19
" 1922 " 1923	+ 10	+ 11
" 1923 " 1924	+ 18	+ 13
" 1924 " 1925	+ 3	− 3
" 1925 " 1926	+ 7	+ 9

of exports and the decline in internal trade correspond with the dip in the production curve[14] in 1925, but seem out of harmony with the inflation at the time.

While the range of variation is considerably greater in the case of exports than in that of internal freight, a curious feature of the above table is a marked tendency for export fluctuations to diminish. Exports were apparently moving away from brusque changes and towards the same kind of relative stability that prevailed in the internal market, in spite of the increasing intensity of monetary disorders. Again it seems that among the multiplicity of factors affecting French exports, currency disturbances did not predominate.

The activity of the domestic market is, in fact, imperfectly measured by the percentage of annual fluctuations in railway and waterway traffic. While the export figures presumably include all exports, the railway and internal navigation figures do not include all the domestic movement of goods, because no account is or can be taken (in the absence of data) of motor-truck transportation, which undoubtedly was of increasing importance in the post-war period. On the other hand, some of the freight carried by railways, rivers, and canals is destined for exportation — which compensates, in part at least, for the omission of motor-truck traffic. The absolute figures, given on page 173, of railway, canal and river freight, show a steady tendency to increase, in spite of slight recessions now and then:

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[13] See below, p. 173.

[14] See above, Chart II, p. 98.

Year	*French railway and internal waterway freight (In millions of tons)*
1919	163
1920	222
1921	214
1922	253
1923	280
1924	318
1925	308
1926	335

In a vague way the fluctuations might be attributed to the fact that inflation stimulates commerce while deflation discourages it, but the general upward movement seems to be more closely connected with the rehabilitation of the industrial north, and the acquisition of new economic and natural resources.

4. Inflation and Agriculture

Conditions in agriculture are so different from those in industry that the effects of a depreciated currency on agricultural production and trade call for special consideration. The general features that distinguish agriculture from manufacturing are commonly known. The outstanding fact of French agriculture, especially significant from the point of view of inflation, is that practically the whole of the produce of French soil is consumed in France so that an almost negligible amount was exported in the post-war years. The exports consisted of little more than border trading carried on by farmers near the frontiers. Thus in so far as the principal effect of inflation is supposed to be a keen stimulation of exports, agriculture could not be affected in this way.

While France is not an exporter of agricultural products, the country does import a considerable quantity of foodstuffs — in fact, from 10 to 25 per cent of the amount consumed come from abroad. It is, therefore, through the mechanism of importation that inflation must have affected French agriculture. As the franc depreciated, the imported foodstuffs cost more and more in depreciated francs and thus the possibility of competition from abroad was excluded. The rising price of imports would be expected also to keep the price of domestic agricultural products at a high level and thus stimulate farm production. Consequently, other things being equal, there seems to be no reason why agricultural products should not have risen in price as much as manufactured goods. It is, however, impossible to determine with certainty whether this occurred or not, because the French index numbers of price are not divided into categories of manufactured products comparable with agricultural products. The likelihood is that agricultural prices did not attain the level of prices of manufactured goods, because through practically the whole post-war period and especially during the acute inflation crises, the price index number of agricultural products remained considerably below that of industrial materials.[15] For instance, in the first quarter of 1926 the prices of the 20 foodstuffs included in the index number of the *Statistique Générale* were on the average 6.3 times the prices prevalent from 1901 to 1910, while the prices of the 25 industrial materials in the same index number had risen on the average in the same interval 8.1 times. The reason is that by far the greater part of the foodstuffs consumed in France is domestic in origin, while a large proportion of industrial materials is imported.

It cannot be affirmed with certainty, on the basis of the data available, whether or not agricultural prices were less affected by inflation than prices of manufactured goods. As has already been observed, the variability of atmospheric conditions is an important factor determining agricultural production, and hence the price of agricultural products. French post-war industrial production, too, was subject to other influences than currency disturbances, but there was more concordance between industrial output and inflation than between agricultural yield and the fall in the franc. This is partly due to the fact that most agricultural production is, of necessity, quoted annually only, whereas a large portion of manufactured output may be measured within shorter time intervals, when the influence of inflation can best be seen.

Imperfect as the annual index of agricultural production[16] may be, its fluctuations seem, on the surface, to bear no recognizable relation to changing currency conditions. There was, for example, a steady and important growth in agricultural output in the early years after the war, which growth showed no signs of abatement in 1921, when industrial production contracted under the pressure of deflation. From 1924 to 1925, when the output of manufactured goods remained practically stationary, the agricultural yield was more plentiful than ever before since the war, thanks to favorable weather conditions. In 1926, when monetary conditions proved to be so conducive to expansion in manufactures, agriculture suffered a sharp decline in its output as compared with the previous year. The principal cause was probably again atmospheric conditions, but there was also a certain falling off in the acreage cultivated in that year.

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[15] See below, p. 491.

[16] See above, p. 105.

The fact is that in the years of acute depreciation of the franc, in 1925 and in 1926, there was less arable land than in the preceding years. The diminution had been progressive; less area was ploughed in 1924 than in 1923 and less again in 1925 than in 1924. The post-war peak had been reached in 1921, when the arable acreage of France represented 96 per cent of the arable acreage of France and Alsace-Lorraine before the war.[17] Thus at no time since the war did the ploughed surface of France regain its pre-war extent, and, what is more significant, the tendency after the war was for this surface to grow steadily smaller.

This phenomenon is very probably not independent of inflation, so that it might plausibly be argued that post-war monetary disturbances led rather to a decline in agricultural production than to an increase, in spite of the stimulating effects of the rising price of imported foodstuffs. The shrinkage which took place in the total productive area is generally attributed to the low labor supply of France and to the shifting of population from rural districts to urban centers. This very movement of peasants and farm workers to the cities is due to the greater economic opportunities and the more intense demand for labor in industrial agglomerations. If, therefore, inflation stimulated the growth of cities and accentuated industrial production more than agricultural production, then indirectly inflation was responsible for the decline in agricultural output by bringing about the abandonment of farm lands. To be sure the growth of cities at the expense of the countryside had been going on for many years, long before the war and the era of depreciated currencies.[18] It is significant, nevertheless, that the total productive areas never increased from the low point immediately following the war to more than 93.5 per cent of the pre-war acreage, and that they diminished especially during the period of greatest monetary depreciation, when the industrial production was very high.

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[17] See below, p. 482.

The influence of inflation on agriculture may be approached from still another angle. How did it affect the costs of agricultural production as compared with its influence on the market price of products of the soil? Among the principal elements of the farmer's cost of production, which will be analyzed in greater detail in Chapter XVI, are payments for machinery and fertilizers, interest on mortgages and other loans, and changing land values. The prices of machinery and fertilizers followed approximately the same course as the wholesale price index number of agricultural products. Machinery alone tended to move up in price somewhat more than foodstuffs in the post-war years, except in 1926, which was an exceptionally good year for agricultural prices. Chemical fertilizers, on the other hand, were relatively cheap, except possibly in 1926. The acquisition of the potash mines in Alsace and the rich phosphate resources in the French North African colonies relieved France of the burden of seeking these substances in countries of non-depreciated currencies. Only nitrates had to be imported.

It was chiefly through paying off their mortgages in depreciated francs that the French farmers and peasants were said to have made their greatest gains in the post-war years. There is, in fact, a tendency to exaggerate the advantages accruing to French rural land owners in this respect, because of an inexact analogy drawn from the German experience. In Germany mortages which fell due when the mark was practically at zero were worthless, and the mortgagors profited enormously by this situation. In France, however, even in periods of most pronounced inflation, the franc never fell to anything like the extent of the German mark in either internal purchasing power or in exchange value, and so French debtors were not at all in the position of German debtors. Moreover, the statistics of post-war mortgage payments in France do not reveal any particular increase in the volume of reimbursements in the post-war years as compared with the pre-war years. The average annual repayments from 1919 to 1925 amounted to 117 million francs, whereas from 1910 to 1913 they had amounted to 101 millions a year.[19] Even if there was not as much paying off of the principal of mortgages as is generally supposed, the farmer still enjoyed certain advantages, for he paid the interest on his debt in a currency of depreciated value. Undoubtedly inflation reduced that element in the French farmer's costs of production arising from mortgage loans.

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[18] See below, pp. 203–205.

Thus the farmer, not unlike the manufacturer, profited by inflation so far as his older debts were concerned. When, however, the farmer found himself obliged to contract new debts in an atmosphere of rising prices and depreciating currency, he met with very much the same difficulty as the manufacturer. Inflation rendered capital scarce and raised the interest rates. Whereas before the war the *Crédit Foncier* charged no more than 5 per cent on real-estate mortgage loans, after the war this maximim rate was raised on several occasions, once reaching 8.25 per cent. Short-term money provided by rural credit organizations controlled and aided by the State cost nearly twice as much in interest after the war as before.

Nevertheless there were many circumstances which rendered rural credit easier to obtain than industrial or commercial credit in the post-war period. Even before the war the State had intervened and made it possible for farmers to contract relatively long-term loans for the purpose of purchasing small parcels of land at the rate of 2 per cent. This same low rate was maintained for that category of loans until as late as 1927, when it was raised to 3 per cent. Not only were the interest rates particularly favorable to the farmer, but the quantity of capital available was more plentiful for agriculture than for industry, thanks to special legislative provisions. The State places at the disposal of the *Caisses Régionales de Crédit Agricole Mutuel* sums which it obtains from the Bank of France, and among these sums is a fixed percentage of the profits of the Bank. To the extent, therefore, that inflation resulted in increased profits to the Bank of France, inflation also increased the quantity of rural credit available.

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[19] Source: *Annuaire Statistique*. No distinction is made in these statistics between mortgages on urban and rural real estate. The repayments were computed by subtracting the loans outstanding at the close of any given year from the sum of the loans made during that year and the loans outstanding at the close of the preceding year. In the years of depression and falling prices the repayment of mortgages diminished, and in periods of rising prices there was a tendency for these repayments to increase except from 1923 to 1924.

One of the most striking circumstances connected with the effects of inflation on agriculture was the relatively low increase in rural land values and in rural rents. There are no official statistics bearing on this subject, but there is sufficient evidence to show that neither farm land values nor rents rose as much as general prices. M. Caziot estimates that in July 1926, when the wholesale prices were 8.5 times as high as before the war, land values were only 2.5 times as high. Another authority, M. Michel, considers agricultural real estate, both land and buildings, at the beginning of 1925 as worth twice as much as before the war, whereas general prices had risen about five times. This represents, at least temporarily, a serious loss to owners of farm land. Their borrowing capacity was greatly hampered because the land security they could offer was worth so little. They lost too because the rents they could obtain corresponded roughly with the land values and were consequently low. The tenant farmer, on the other hand, profited by the situation.

On the whole, it appears that changes in the costs of farm production did not keep pace with changes in the price of farm products, so that in all probability the French peasant and farmer found a certain advantage in inflation. Their labor costs, their expenditures for fertilizers and their mortgage charges were all reduced. On the other hand machinery cost them dearly, and they had difficulty in obtaining sufficient labor and credit. These difficulties were so serious that they often resulted in the abandonment of farm lands.

There were also certain other changes in agriculture and in the status of the French farmer and peasant, but the relation between these changes and inflation is difficult to prove. The general opinion seems to be, for example, that the farm laborer and the small peasant were better off in the post-war period than before the war. They are said to be better fed, to eat meat more frequently, to be better clothed and housed than ever before. There is no verifiable way of tracing these improvements to inflation. The better rural living conditions may, indeed, be simply part and parcel of general technical and economic evolution — quite independent of monetary phenomena. There is also the impression abroad that peasant proprietors of small holdings were more numerous after the war than before, owing to cheap credit, low rural rents and labor difficulties. Because of the scarcity of labor, more agricultural machinery, especially of the smaller type, came to be used in the post-war years. The quantity of fertilizer employed on French farms increased too, a fact perhaps more closely related to the new material resources of France than to inflation. Yet the increased use of machinery and fertilizer is not entirely unconnected with monetary phenomena, for after the war the peasant was weaned away from the traditional custom of investing his savings in state bonds because of the low yields and diminished capital value of these bonds. It was more profitable for him to use his spare cash for improving his working equipment. The young farmer, however, who had no accumulated savings, found it more difficult to procure sufficient working capital than to acquire land, because machinery was more expensive than land, and the credit facilities were greater for purchasing land than for buying equipment.

5. CONCLUSIONS

A

Certain available data on inflation, and its probable effects on exports, imports, domestic trade, production and costs of production have now been examined. While it has not been difficult to show the relation between inflation and price movements, it has proved to be exceedingly perplexing to demonstrate any well defined causal nexus between monetary disturbances on the one hand and the post-war movement of production, trade, equipment, etc., on the other. It would seem, therefore, that the current theories, which are derived deductively from a study of price data, overestimate the effects of inflation on production and trade. There are numerous other factors, physical and psychological, which limit the influence of inflation, but which are not taken into account in usual deductions.

It is true that the course of production and trade was indisputably upward in the long period of depreciated currency in France. This may be little more than a coincidence, and may merely indicate that the milder forms of inflation, such as prevailed in France, in contradistinction to the catastrophic inflation of Central and Eastern Europe, were not detrimental to industry — at least during the period studied. Any doubt one may entertain as to the predominating influence of inflation is further confirmed when the depreciation of the franc is compared with the more detailed movement of specific branches of trade and industry. The post-war intensification of industrial activity in France was due very largely to the rapid rebuilding in the north after the war which gave an unprecedented momentum to productive expansion. It was also simply part of the normal evolution of modern industrial nations in the present epoch of technical progress. France enjoyed, moreover, the stimulus that came with the acquisition of new natural and industrial resources.

Although it may well be argued that the effects of inflation on the economic life of France were less important than the spectacular and impressive incidents of currency depreciation would lead one to imagine, nevertheless there is evidence to show that industry did profit by the situation. The low gold values of French manufactured products brought about a certain expansion of markets abroad. The diminution in costs of production stimulated industrial activity, while the flight from the franc on the domestic market opened a sufficient home outlet for the increased flow of goods. In the latter years of inflation, French industry suffered, however, from the scarcity of capital. Indeed French inflation was not a single, homogeneous phenomenon, but a movement with various phases, each phase being accompanied by a different set of circumstances.

The evidence pointing to the favorable effects of the depreciation of the franc on industry is not presented as a general defense of the policy of monetary inflation. From the point of view of the state budget and public finance, inflation is probably as disastrous as specialists in those fields point it out to be. It undoubtedly ruined certain economic classes in France, and caused others to suffer heavy losses. It upset values. Although industry and trade were profiting by inflation, yet it seemed reasonable at that time to anticipate a ruinous aftermath as soon as inflation should cease. If, indeed, no calamity has actually attended the *de facto* stabilization of 1927 and the legal stabilization of 1928, it is because the expanding economic life of France and her increasing industrial activity are more independent of monetary conditions than is generally believed to be the case.

CHAPTER VIII

THE INDUSTRIALIZATION OF POST-WAR FRANCE

IN the preceding chapters a summary description has been given of the economic recovery of post-war France in the face of serious financial difficulties. It has been seen that progress left a very decided mark on industry, while agriculture was practically untouched. The new development, therefore, took the form of industrialization; and the rising edifice of larger industry rested, as has been observed, on solid foundations of basic resources. These facts have led certain writers to regard France as undergoing a second "industrial revolution." Is it true?

The answer to this question demands an examination of the post-war changes in their historical perspective. There is, for example, nothing particularly new in the mere process of industrialization, for it had been going on in France for more than a century and a half before the war and at a constantly accelerated rate. The problem narrows itself down, therefore, to an inquiry as to whether and to what extent the newer developments have taken place at an unprecedented speed and have assumed larger proportions than were known before.

It is perhaps well, as a first step in the examination of this matter, to set forth clearly what is meant by industrialization. Strictly speaking it may be defined as the development of the use of mechanical, as distinct from human or animal, power to be harnessed to machines and tools in the process of production. This definition is obviously barren of any indication of the significance of the phenomenon and of its widespread social and economic consequences.

The historical beginnings of the process of industrialization are conventionally called the "industrial revolution," which takes in the early period of transition from the agricultural and handicraft era to the modern epoch dominated by steam and electricity and by machines of iron and steel. The term "industrial revolution" implies that the change was sudden; and, in fact, if the long preliminary period of groping and partial discoveries be ignored, the industrially applicable inventions, mechanical, metallurgical and dynamic, came very close together in point of time. Moreover the movement got under way in a limited area — in Western Europe — and from there spread outward along routes of contact to continents beyond the seas, where it continued to develop.

France, being situated geographically in the very center of diffusion, had, as has already been noted, undergone a fundamental industrial and commercial transformation during the first half of the nineteenth century. By that time the countries in the periphery had already come more or less under the influence of the "industrial revolution," so that from 1850 on the progress of France had to be tested not only by comparisons with her own past but also by the achievements of other lands. It was found that as the complex of industrial inventions was diffused over the face of the earth there were some nations which accepted and developed it more readily than others. France, for various natural, social and historical reasons, was not in the van among the great industrial countries in the period from 1850 to 1914. This was, however, too short a period to permit one to draw any definite conclusions as to the real position of France in the great process of industrialization which is secular. The post-war years revealed France in a state of revived industrial activity, and the future may reveal even greater changes.

The fundamental transformation in the technique and organization of production affects social life profoundly. It is known, for example, that industrialization is usually accompanied by a very notable increase in material riches. For one thing, centers of wealth are situated in the very heart of modern industrial regions. Moreover, the general plane of material welfare is probably higher now for all classes than it ever was in the past, though there may be exceptions to this generalization in periods of economic or industrial crises when the lot of the poorer classes is most wretched. The rise of the modern factory has brought with it the development of big cities with their substantial comforts and conveniences —

and also their sordidness. And as wealth has increased, it has tended to become more and more radically redistributed, for a moneyed bourgeoisie has taken the place of the old landed aristocracy, and a vast proletariat without significant property has arisen and furnished "hands" for the factories.

The "industrial revolution" has wrought tremendous changes in the family, the importance of which has diminished greatly not only as a producing unit, but as a social entity. Many functions that once belonged to the family have been taken over by the State, and have been developed and modified. Other family functions have passed to private organizations, often industrial, which are constantly extending their welfare work. Thus in post-war France, the State and private industry seriously compete for a greater share in the allotment of social functions — particularly those connected with insurance and social hygiene, once matters of family concern only.

Within the family the position of women and the organization of the home have been entirely recast with the progress of industrialization. Where, as in pre-war France, many vestiges of eighteenth-century economic organization survived into the twentieth century, the social and legal status of women bore prominently the earmarks of a distant past. Observers generally agree that there has been a very striking change in this respect in France during the post-war period under consideration in this study — but it is not possible to determine exactly to what extent the new position of French women is due to industrialization, and how far it is due to the peculiar exigencies of the war.

The industrial development of modern times undoubtedly has exercised an extremely important influence on other than social aspects of occidental civilization, but the precise line of causation is almost impossible to trace because of the multitude and complexity of interdependent factors involved. Religion, art, literature, education and recreation all have undergone more or less basic changes. It is often maintained that factory mass production destroys the personal and esthetic relationship of the worker to his work, which prevailed in the age of handicrafts and which gave rise to the beautiful masterpieces of the artisans of yore.

Every nation within the orbit of Western European and American civilization has been obliged by competitive necessity to submit to or espouse a program of constantly expanding machine production. Industrialization certainly has given a new color to the elements of monotony, liberty, independent thought, and individuality in the process of production. Many of the things for which France is famous and loved, the richness and variety of her artistic creations, and the greater freedom of individual expression, have been profoundly altered — if not diminished — by the advent of industrial progress.

Such have been the outstanding social and cultural consequences of the coming of the "machine age." The more immediate monetary, commercial and industrial effects are common knowledge. They occur almost simultaneously with the increased use of machines and power, for they are in reality integral parts of the process. On the other hand, changes in social institutions, social values and other group phenomena correlated with industrialization do not generally take place at once, but require time to crop up. Though the modern world has been in the process of revolutionizing itself industrially for more than a century and a half, it is not yet clear what the social effects are or may become. That is probably due to the fact that the "industrial revolution" does not simply mark the passage from one static condition to another, but is evidence of continuous change.

If it is true therefore that with a greater or smaller lag social revolutions follow in the wake of industrial revolutions, and that both are long-cycle phenomena, it is clearly impossible to describe the social and cultural changes which may be correlated with less than a decade of industrial development in post-war France. It is possible, however, to describe the industrial changes themselves regardless of their manifold consequences. The progress achieved in the technique of production in post-war France has already been treated in preceding chapters, but certain aspects of industrial development remain to be examined in order to make a comparison of the more recent rate of growth with that of the past. It is proposed, therefore, to single out certain indices that measure approximately the process of industrialization.

1. Indices of Industrialization

Indices of industrialization are intrinsically of limited significance. By definition an index is a highly generalized measure — a point or a series of points resuming something infinitely larger and fuller. It is a condensation and therefore very inadequately descriptive, just as an average is less fully descriptive than a frequency distribution. For so general and so complex a process as industrialization, no single index can be a completely representative sample. Moreover, a series of index numbers, when used to compare variations in intensity of a given phenomenon over many years, may give an erroneous impression, because the component forces and factors of that phenomenon may vary from time to time. For example, the consumption of coal does not have the same high value as an index of machine activity in the twentieth century as it had in the nineteenth century because of the introduction of a new factor: the use of electricity generated by water power.

The following indices, considered separately, are fragmentary descriptions, and each examined alone is likely to give a distorted view of industrialization in France. It is only when all are taken together that they furnish a fairly representative picture of the relative rate of industrial progress in post-war France.

The Consumption of Coal

Coal is the greatest single source of power known in contemporary times. Oil and waterfalls are serious competitors and are being used more and more widely to furnish power, but by far the greater part of the total kilowatts of energy in all countries is still derived from coal. Not all the coal consumed, of course, goes into power-generating furnaces. Some of it is utilized for domestic heating, some for cooking, some for chemical purposes, etc.; nevertheless these are all subsidiary uses and account for only a small percentage of the total coal consumed. Consequently, as a basis of comparison over a period of years, the annual per capita consumption of coal represents with fair accuracy the application of mechanical sources of power to industry.

To what extent did the consumption of coal increase in France

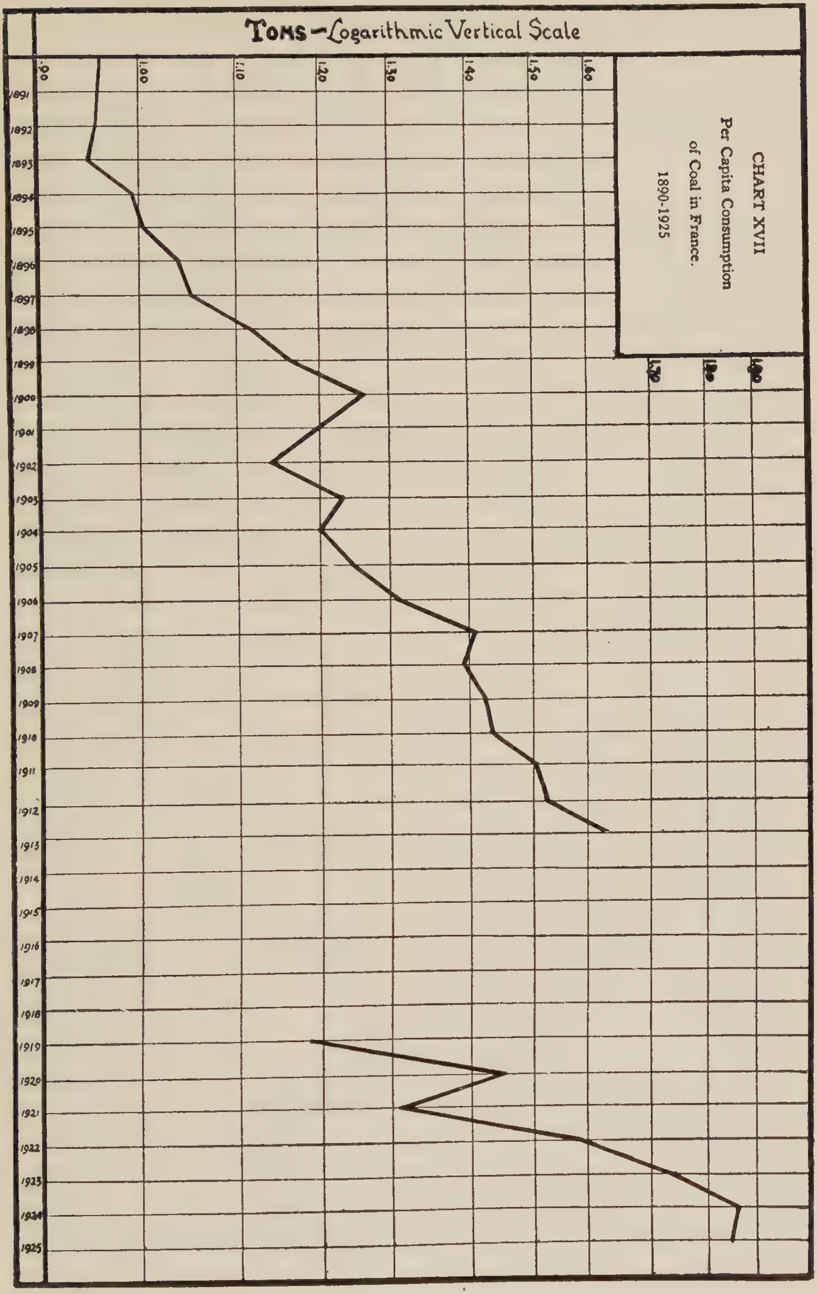

CHART XVII
Per Capita Consumption
of Coal in France.
1890-1925

in the post-war years? In 1919, 1.18 tons were consumed per unit of population, and this figure rose to 1.95 tons in 1926,[1] representing an increase of nearly 65 per cent in the short space of seven years. In a similar interval from 1906 to 1913, the rise in the per capita consumption of coal was only 24 per cent. Is one then not justified in speaking of a second "industrial revolution" after the war? Not quite, for the consumption of coal was abnormally low in 1919 and in the early years after the war. If the per capita consumption of 1926 is compared with that of 1913, then the increase between these two more normal years at 13 years' distance is seen to be of no greater measure that 19.5 per cent.[2]

Thus in so far as the consumption of coal may be regarded as a measure of industrialization, France made appreciable progress from 1913 to 1926. This was, however, due, for the most part, to the reannexation of Alsace-Lorraine, as is clearly seen from the fact that the per capita consumption in the combined territory of France and Alsace-Lorraine in 1913 was 1.82 tons as compared with 1.63 tons in France alone in that year. It must be remembered also that industrialization, at least in the form of expanding per capita consumption of coal, was going on fairly rapidly before the war. If the same rate of increase in French coal consumption that had taken place from 1900 to 1913 be assumed to have occurred in an imaginary period of 13 years of peace after 1913, then the per capita consumption of coal in France alone, without Alsace-Lorraine, would have been 2.54 tons in 1926, instead of the actual 1.95 tons for France with Alsace-Lorraine.

Moreover, even the figure of 1.95 tons per capita is very probably the product of abnormal circumstances, and therefore not a measure of definitive progress. The years 1924, 1925 and 1926 constituted a period of acute inflation, when industry was extraordinarily stimulated. Once the effects of this stimulus have worn away, the per capita consumption of coal may even decline. The drop will, in all likelihood, reflect only a temporary reaction, and the general trend will probably still be upward.[3]

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[1] For the purpose of this calculation the Saar was not included, although that area came into the French customs union in January 1925. The consumption for France exclusive of the Saar in 1925 was 75,631 million tons. — League of Nations, *Memorandum on Coal*, Vol. I, p. 75, footnote 1. For data, 1890–1926, see *Annuaire Statistique*.

[2] The comparison is here made between the disparate pre-war and post-war areas of France, but it is not necessary to make any adjustments because it is the progress of the French nation as such, regardless of territorial changes, which is being measured.

It appears, therefore, that there is no evidence of a second "industrial revolution" in France, at any rate from the point of view of the consumption of coal. The spectacular increase from 1919 to 1926 was due simply to the exceptionally low consumption in 1919 and not to any particularly stupendous activity in 1926. If Alsace-Lorraine be included in pre-war France for purposes of comparison with post-war achievements, then no significant increase at all in the consumption of coal is noted from 1913 to 1926. It would be rash to conclude from this, however, that there was a complete absence of industrial progress in France during those years, for the post-war period was characterized by a rapid increase in the consumption of hydraulically generated electricity and of oil for the production of power.

The Consumption of Iron and Steel

Power (of other than animal origin) and machines are the two pillars which support the whole structure of modern industrialism. The consumption of coal — as the principal source of power — has just been considered. The consumption of iron and steel, as the main source of material of which machines are made, remains to be examined. The uses of iron and steel, like the uses of coal, are manifold. For example, a large quantity enters into the fabrication of commodities which belong to the general class of consumers' goods. Even in France, iron and steel are being employed more and more in the construction of buildings other than factories. Nevertheless it is still probably true that most iron and steel consumed is absorbed in the manufacture of machinery and producers' goods. The per capita consumption of these metals from year to year may, therefore, be taken as a substantially representative index of industrialization in France.

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[3] See below, pp. 227–229.

The consumption of iron and steel is variously estimated according to the different categories of metal objects included in the production and foreign trade computations. For the purpose under consideration the French consumption of iron and steel is conceived of as comprising only those final products of cast iron, iron and steel which receive no further elaboration, whether they be producers' or consumers' goods.[4] This classification differs from that usually presented, in that it includes the balance of foreign trade in manufactured objects, such as machines, boilers, instruments, etc.

The per capita consumption of finished iron and steel products thus calculated was 140 kilograms in 1913 in the pre-war territory of France. In 1924 this consumption attained 161 kilograms in France and Alsace-Lorraine, and was at about the same level in 1926 (the inclusion of the foreign trade statistics of the Saar makes it difficult to calculate consumption accurately from 1925 on). The increase from 1913 to 1924 was of the magnitude of 15 per cent. In view of the fact that there are no statistics available for consumption in Alsace-Lorraine before the war, it is difficult to determine whether and to what extent the 1924 figure represents an increase over the 1913 consumption in France and Alsace-Lorraine. It is quite probable that the per capita consumption of iron and steel products in Alsace-Lorraine was rather small before the war, despite the fact that Lorraine was a great steel producing region. Immense quantities of raw steel and even of semi-finished products

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[4] The method of computing estimates of iron and steel consumption was the following: The consumption of iron was taken as including all pig iron ("fonte") consumed except that which entered into the manufacture of cast steel ("acier fondu"). Thus cast iron ("fonte de moulage") and weld iron and steel ("fer et acier soudé") products were accounted for. To determine consumption, imports were added to domestic production and exports were subtracted. The consumption of steel was calculated by subtracting from the domestic production of cast steel three categories of net exports: 1. raw and semi-manufactured iron and steel ("fer et acier"), 2. finished iron and steel products ("produits des industries mécaniques"), and 3. scrap ("limailles et ferailles"). The net export figures for finished iron and steel products are inaccurate because some of the articles included contain wood, copper, tin and other metals. The error is probably not very great, however, and is perhaps partially compensated by the exaggeration in the figures of consumption of domestic products which include waste and count some of the scrap twice. The resulting estimate is precise enough to measure the general trend from year to year. See Appendix C, p. 590.

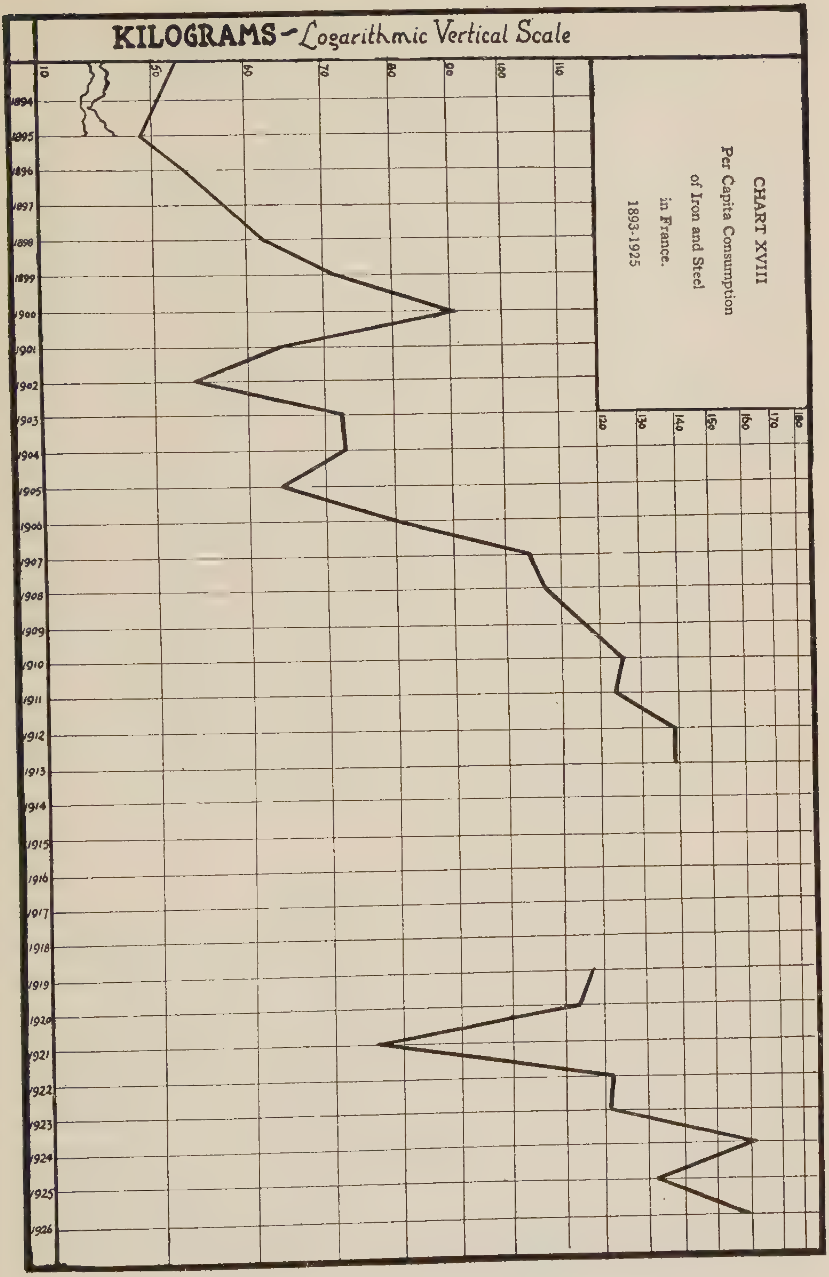

CHART XVIII
Per Capita Consumption
of Iron and Steel
in France.
1893-1925

were consumed there, but the finished articles were generally shipped away. The 15 per cent rise in per capita consumption of iron and steel from 1913 to 1924 may, therefore, be considered as real, and not specious or due simply to territorial expansion.

There is nothing particularly spectacular in such an increase, any more than there was in the 19.5 per cent augmentation in the per capita consumption of coal from 1913 to 1926. Indeed, for the length of time in which it took place, the progress was sluggish. From 1901 [5] to 1913 the per capita consumption of iron and steel rose 118 per cent, that is, it more than doubled. If the same rate of increase had been maintained after 1913, the 1924 per capita consumption would have been about 300 kilograms instead of 161 kilograms.

The 1919 per capita consumption of iron and steel, while not very low (117 kilograms), because of the heavy imports which were required to meet the reconstruction needs of France after four years of war, was still 13 per cent below the average 1910–1913 consumption. In spite of this inferior starting point the augmentation in per capita consumption from 1919 to 1926 was of the order of 36 per cent, while from 1906 to 1913 the increase had been one of 75 per cent. In other words, although there is evidence of progress in industrialization as measured by the consumption of iron and steel in post-war France, it is clear that it did not take place at so rapid a rate as before the war.

Steam Engines in Industry

The latent energy crystallized in coal is generally extracted and applied to industry by means of steam engines. Burning coal under a boiler was at first the sole method employed, but of late the practice has grown up of distilling coal to obtain gas which is used in combustion engines. Nevertheless the steam engine still remains the predominant medium in the application of coal power to production. It is for this reason that fluctuations in the capacity

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[5] 1901 was taken rather than 1902, because in the latter year consumption was exceptionally low. If the increase were measured from 1900, when the per capita consumption was much higher than in the years preceding or immediately following, the rise would be one of only 54 per cent.

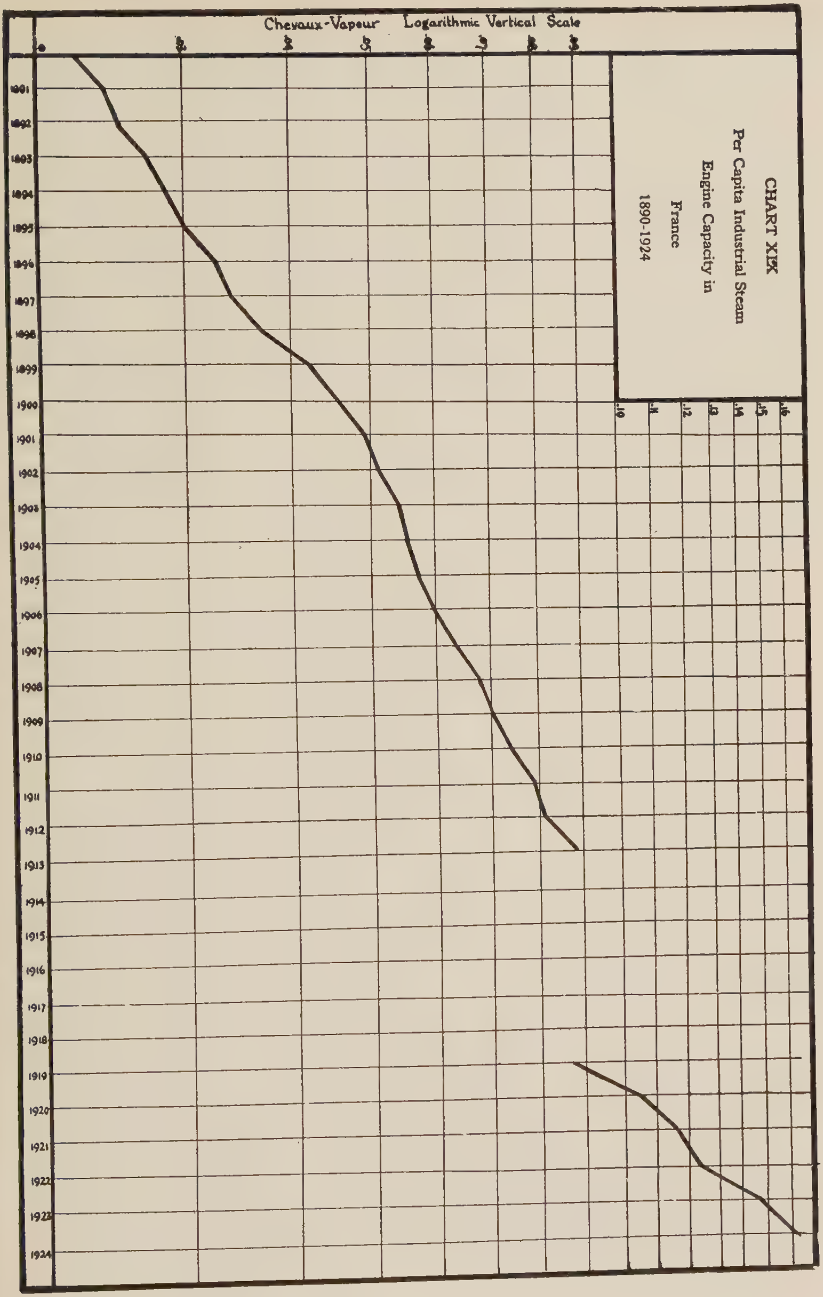

CHART XIX
Per Capita Industrial Steam
Engine Capacity in
France
1890-1924

of steam engines in France may be examined as another index of industrialization.

The statistics of steam engines in French industry represent capacity only and do not take into account the extent to which this capacity is used. Hence the rise and fall in this index during periods of prosperity and depression are not as marked as the fluctuations in the indices of the consumption of coal or iron and steel. It is, therefore, a more significant measure of the steady trend of development in post-war France, for the capacity of steam engines did not fall so far below the 1913 level immediately after the war as did the consumption of coal and steel, nor did it rise so high when production was stimulated by inflation.

In 1919 the power-producing capacity of steam engines in French industry amounted to 3.35 million horse power (*chevaux-vapeur*),[6] as compared with 3.54 million in 1913.[7] There was thus a small net loss of about 6 per cent, in spite of the reannexation of Alsace-Lorraine.

The horse power of industrial steam engines per capita in France rose from .087 in 1919 to .163 in 1924, that is, nearly doubled within a short period of five years.[8] There had been nothing in the annals of the pre-war period to equal so great an upward bound, although the progress then had been notably rapid. From 1908 to 1913 the increase amounted to 33 per cent, as compared with 87 per cent in the post-war years. Moreover, since the annual rate of increase had been fairly uniform in the decade preceding the outbreak of the war, if the pre-war trend of increase in steam engine capacity be hypothetically projected up to 1924, it would reach about the same figure it actually attained in that year in France and Alsace-Lorraine.

Thus it is clear that the index of steam-engine capacity reveals a much more sustained industrial growth than either the index of coal consumption or that of iron and steel consumption. Sight must not be lost of the fact, however, that in view of the development of new sources and new machinery for producing power, the increase in steam-engine capacity represents only partially the real progress made in industrial energy.

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[6] The French unit, "cheval-vapeur" = .986 horse power; for the purpose of this study it may be taken as the equivalent.

[7] These figures include all steam engines, even those used to generate electricity — except marine and railroad engines.

[8] See *Annuaire Statistique.*

Population Engaged in Industry

Changes in the number of persons engaged in industry are also indicative of industrial development. Absolute increases from period to period are, in reality, evidences of progress, although at first glance this would not seem to be the case. Since the substitution of mechanical power constitutes the very essence of industrialization, any augmentation in the number of human beings engaged in industry would appear *a priori* a sign of retrogression. That such is not the case is due to the fact that the rôle of the human being in industry has changed; he is no longer, as he was in the eighteenth century, a source of power, but a tender and overseer of machines which derive their power from steam, waterfalls, electricity, combustion engines, etc. The more machines there are, the more human tenders are required. That is why increases in the population engaged in industry in a modern nation may be taken as indices of industrialization.

What was true in the early stages of the "industrial revolution" is, in a sense, still true in the twentieth century, namely, that machinery takes the place of human beings. In more recent times, however, machines do not often oust the human element, but rather fill gaps where there is already a shortage of labor, or else machines arise to perform productive functions which had never been performed before by human beings or any other agency. There is evidence to show, for example, that the low rate of increase in the population of France, which led to a great importation of immigrant labor in the post-war period, was also the occasion in many instances of the introduction of machinery. This was very analogous to the situation in the United States, where high wages and a limited immigrant labor supply explain in large part the intense application of machine production. Nevertheless, the industrialization of France, like that of the United States, consisted of something much more than the mere substitution of human labor by machines, for the mechanical energy that was harnessed to industry in the course of the past century was infinitely greater than the muscular power displaced. The new sinews of steel bars and cogs moving in massive cast iron skeletons demanded human direction and assistance, and so the proportion of the population of advanced nations engaged in industry is undoubtedly larger today than in any previous epoch.

Unfortunately the statistics of persons engaged in industry are recorded in France at infrequent intervals — only every five years. The earliest French census of industrial population goes back no further than 1851, and the latest reports published refer to the 1921 census. The following table gives the number of persons engaged in industry in France, as distinct from those engaged in commerce, public administration and the liberal professions:

Year	*Gainfully occupied persons engaged in industry*[9] *(In millions)*
1896 (without Alsace-Lorraine)	6.4
1901 " " "	7.0
1906 " " "	7.2
1921 " " "	7.5
1921 (including Alsace-Lorraine)	7.8

The 1911 census, which was the last taken before the war, enumerated 7.5 million persons engaged in industry, but this figure is not comparable with those of the table above because it is based on a classification of individuals according to their occupations, and not according to the nature of the enterprise to which they happen to be attached. The increase from 1906 to 1921 is significant because of the fact that there was practically no change in the total population of France from 1906 (39,267,000 without Alsace-Lorraine) to 1921 (39,240,000 including Alsace-Lorraine).

The course of progress in industrialization in France is even more clearly revealed by the changing proportion of the number of persons engaged in industry to the total gainfully occupied population:

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[9] *Résultats statistiques du Recensement général de la Population, 1921*, Vol. I, Part III, p. 8.

Year	*Ratio of persons engaged in industry to total gainfully occupied population*
1896 (without Alsace-Lorraine)	34.7%
1901 " " "	36.6
1906 " " "	35.9
1921 " " "	36.5
1921 (including Alsace-Lorraine)	36.8

The period from 1901 to 1906 does not appear to have been one of industrial development so far as can be measured by the above percentages. There was, however, a perceptible gain from 1906 to 1921 in spite of the war. It is evident, too, that the reannexation of Alsace-Lorraine intensified the industrial life of France.

The Size of Industrial Establishments

One of the outstanding features of the era that preceded the "industrial revolution" was the prevalence of small-scale productive establishments. The contrast between the present and the past in this respect is not as marked in the case of agriculture as in that of manufacture. The growth in the size of industrial establishments is, therefore, another characteristic aspect of the process of industrialization. From this it must not be inferred that in all cases the larger the plant the more efficient and modern it is likely to be. On the whole, however, establishments tend to expand with the development of industry.

There has been a slow but constant movement in modern France toward a diminution in the proportion of small-scale plants to the total number of industrial establishments:

Year	*Ratio of industrial establishments employing 1–20 persons to total number of industrial establishments in France* [10]
1896 (without Alsace-Lorraine)	96.7%
1901 " " "	96.5
1906 " " "	96.4
1921 " " "	94.2
1921 (including Alsace-Lorraine)	94.1

[10] Establishments with no employees are not included. *Résultats statistiques, 1906*, Vol. I, Part II, p. 124; *1926*, Vol. I, Part III, p. 66.

While the decrease in the number of small-sized plants was very slow from 1896 to 1906, it was certainly much more rapid from 1906 to 1921. Were the 1926 figures available, the change would undoubtedly prove to be even greater.

Not only do successive censuses show a diminution in small-scale establishments, but they indicate a steady and important increase in the relative number of large-scale plants:

Year	*Ratio of industrial establishments employing 100 or more persons to the total number of industrial establishments in France*
1896 (without Alsace-Lorraine)	.62%
1901 " " "	.70
1906 " " "	.75
1921 " " "	1.19
1921 (including Alsace-Lorraine)	1.22

Again the tendency toward large-scale industry was more intense between 1906 and 1921 than in the preceding periods; and there can hardly be any doubt that the rapidity of this transformation was maintained, if not surpassed, in the post-war period.

Foreign Trade in Manufactured Goods

The volume of imports and exports of manufactured goods gives some indication of the condition of industrial development, for it reflects the status of manufacturing within a country. Such an index is of little value for international comparisons because of differences in area and population from country to country. Within a given country, however, over a period of years, fluctuations in the exportation of manufactured goods represent changes in general industrial activity. While such exports indicate practically nothing regarding the domestic consumption of home-manufactured articles, like producers' goods, which contribute to industrial growth, they do point to a certain economic expansion which takes place when the proceeds of the sale of manufactured goods abroad are

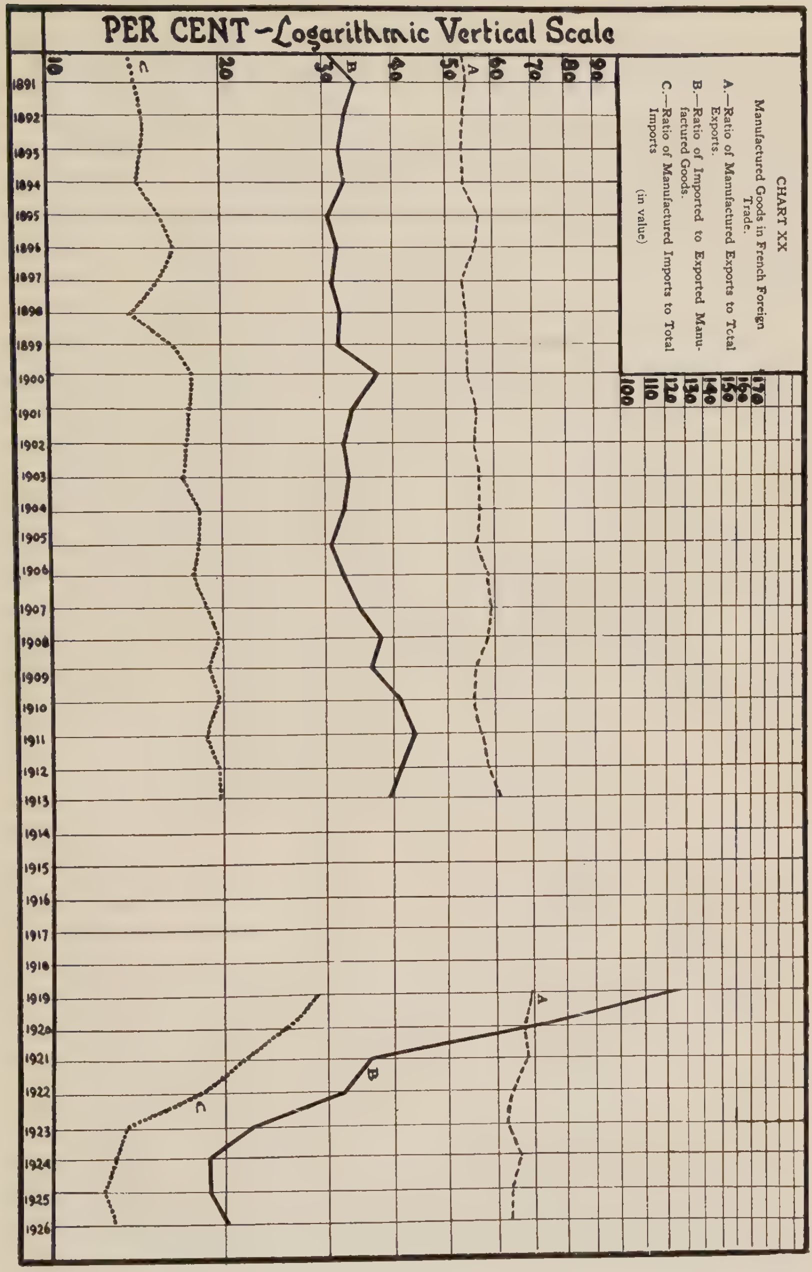

CHART XX
Manufactured Goods in French Foreign Trade.
A.—Ratio of Manufactured Exports to Total Exports.
B.—Ratio of Imported to Exported Manufactured Goods.
C.—Ratio of Manufactured Imports to Total Imports
(in value)

invested in imported raw materials, or when these funds serve to swell the quantity of purchasing power available in the home market for consumers' goods. As a matter of record, highly industrialized nations are the principal exporters of manufactured goods. The converse is equally true: that industrially backward nations are generally great importers of manufactured goods and purveyors of raw materials and foodstuffs. The degree of industrialization may therefore be inferred from the sales of manufactured goods abroad.

Before the war, France, like all advanced countries at that time, exported more manufactured goods than it imported. In 1913 the ratio of manufactured imports to exports of the same general category [11] was 40 per cent when measured in value. During the quarter of a century which preceded the outbreak of the war there had been but little development in this proportion. In 1900, for example, the ratio was 37 per cent, and in 1890, 31 per cent, but in the intermediary years there were oscillations back and forth indicating no definite trend.

The foreign trade statistics of the post-war period tell a very different story, as is seen in the following table:

Year	*Ratio of value of imported to value of exported manufactured goods*
1913	40%
1919	125
1920	71
1921	37
1922	33
1923	23
1924	19
1925	19
1926	20
1927	18

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[11] This category is designated in French official foreign trade statistics as "objets fabriqués" which are distinguished from "matières nécessaires à l'industrie" and "objets d'alimentation."

Thus in the period from 1923 to 1927 the ratio maintained itself at a lower level than had been reached at any time in the course of the preceding thirty years.

What these low ratios imply is not entirely clear. They may indicate, as was previously observed, that French industries, in expanding, became more varied during the post-war period, and supplied the home market with manufactured goods formerly imported. The rise in import duties could hardly have accounted for this phenomenon. Undoubtedly the loss of French investments abroad resulted in a certain reduction of manufactured imports, but as most of these investments were situated in Eastern and South-Central Europe, where industry was backward, the effect on the above ratios was probably not very marked. The newly acquired manufacturing capacity of Alsace-Lorraine certainly rendered France industrially more self-sufficient than she had been before the war, but there is no apparent reason why the effect on foreign trade should have been very much greater after 1923 than before that year. The low ratios of the value of imports to exports of manufactured goods during the latter part of the post-war period were probably due, for the most part, to the inflation of French currency, which raised enormously the cost of purchases from countries with stable money. The more direct correlation between inflation and relatively diminished manufactured imports seems all the more plausible because of the simultaneousness of the two events.

The ratios considered up to the present, being based on values, are likely to give an exaggerated notion of the volume of imports as compared with exports. The imports from countries with gold or high currency standards were relatively much more expensive than the exports from France where the costs of production were paid in paper francs. This difficulty may be obviated by comparing from period to period the ratio of the value of manufactured imports to the value of all imports, and by doing the same for exports. Or again, the ratios of the weight of manufactured imports to the total weight of imports and of the weight of manufactured exports to the total weight of exports may be compared from year to year. The value comparisons are nevertheless preferable to weight comparisons, despite the fact that the former embody the disturbing factor of the fluctuating franc, because they are more sensitive to changes in the nature (and not merely the bulk) of the commodity traded.

It was seen above that from 1923 to 1927 the value of imported manufactured goods fluctuated between 11 and 13 per cent of the value of all goods imported, while in 1913 the proportion was about 20 per cent.[12] In fact the 1923–1927 ratios were lower than any that had existed during three preceding decades. Moreover, the proportion in the weight of manufactured imports to the weight of all imports was also less from 1922 to 1927 than in 1913:

Year	*Ratio of weight of manufactured imports to weight of all imports*
1913	3.51%
1919	4.76
1920	4.88
1921	3.93
1922	3.23
1923	2.68
1924	2.61
1925	2.63
1926	2.99
1927	2.32

Meanwhile the proportion of manufactured goods exported to total exports attained unprecedented levels. For example, even in value — and values of manufactured exports in depreciated francs were bound to be underestimated — the ratio varied, as has already been observed, between 63 and 65 per cent during the years 1923 to 1926, but fell to less than 60 per cent in 1927.[13] In 1913 it had been 61 per cent, and in the three decades before that it never once attained 60 per cent. In weight the manufactured exports of 1927 were more than twice as great as those of 1913. The following table shows the changes which took place during the post-war years in the proportion of the weight of manufactured exports to total exports:

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[12] See above, p. 115.

[13] See above, p. 114.

Year	*Ratio of weight of manufactured exports to weight of all exports*
1913	10.2%
1919	15.5
1920	14.5
1921	11.8
1922	11.3
1923	12.4
1924	12.3
1925	14.0
1926	14.7
1927	14.3

The relative movement of French imports and exports of manufactured goods indicates at one and the same time an important diminution in the dependence of France on other industrial countries during the post-war years, and a great development of sales of products of French factories on the international market. The post-war foreign trade statistics are symptomatic of important progress in manufacturing activity, and hence of industrialization. The figures do not show, however, how much of this change may be due simply to accretion, through the reannexation of Alsace-Lorraine, and how much to real intensification of industrial activity.

2. INDUSTRY *VERSUS* AGRICULTURE

The use of machinery driven by power derived from coal, oil, or electricity is not confined to manufacturing. Agriculture in modern times is resorting increasingly to mechanical appliances. Thus, there are tractors, threshers, milking machines, etc., utilizing gasoline, electricity, fuel oil or coal. The application of machinery to agriculture, however, is very slight when compared with its use in factories or for transportation. Indeed so recent and so relatively insignificant has been the development of agricultural machines that one ordinarily thinks of the "industrial revolution" as concerned exclusively with manufacturing, mining and transportation.

The practice has grown up of classifying certain countries as agricultural, and others as industrial, according to the predominance of one form of productive activity over the other. This attitude is justified by the fact that the process of industrialization as it affects any country consists very largely in a general shifting of emphasis from agriculture to manufacturing. In the pre-industrial era all countries were mainly agricultural and their only other significant form of economic activity was commerce. Evidences of the relative decline in the importance of agriculture to the profit of industry are certainly among the indices by which the industrialization of a country may be measured.

These indices, however, are valueless for comparing the industrial status of different countries at a given time. For example, a vast country like the United States, containing a very extensive agricultural area as well as important industrial regions, may show a predominance of agriculture. Yet the industry of the United States is more highly developed than that of a small country like Belgium, where industry, nevertheless, takes precedence over agriculture. Within a given territory, on the other hand, the relative progress of industry as compared with agriculture over a period of time is highly indicative of industrialization.

The extent of the desertion of fields for factories may be measured by the growth of cities. Urban development in France is shown in the census statistics by the rising proportion of that part of the total population which dwells in communes of over 2000 inhabitants:

Year	*Ratio of urban population to the total population of France*[14]
1881	34.8%
1886	35.9
1891	37.4
1896	39.1
1901	40.9
1906	42.1
1911	44.2
1921 (without Alsace-Lorraine)	46.3
1921 (including Alsace-Lorraine)	46.4

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[14] *Résultats statistiques du Recensement général de la Population, 1921,* Vol. I, Part I, p. 59.

It is seen in the above table that the increase in the proportion of population living in cities was of the magnitude of 5 per cent from 1911 to 1921. In the previous decade it had risen 8 per cent. The retardation was probably due rather to the fact that in 1921 France was still suffering from some of the direct devastation of the war than to any slackening in the process of industrialization. Unfortunately the 1926 census figures showing the ratio of urban population to total French population are not yet available (1928), but there can hardly be any doubt that they will show a very sharp upward bound. It is known, for example, that from 1921 to 1926 the number of communes of more than 20,000 inhabitants rose from 140 to 159 — representing an increase of 13.5 per cent in 5 years, while the increase in 10 years from 1911 to 1921 was of only 3.7 per cent. That this growth of cities took place at the expense of rural communes appears from the fact that communes of 2000 or less inhabitants decreased from 35,424 in 1921 to 35,302 in 1926.[15]

When the population of any nation shifts from country farms to city factories, the number of persons left to produce food naturally diminishes, while at the same time the number of persons to be

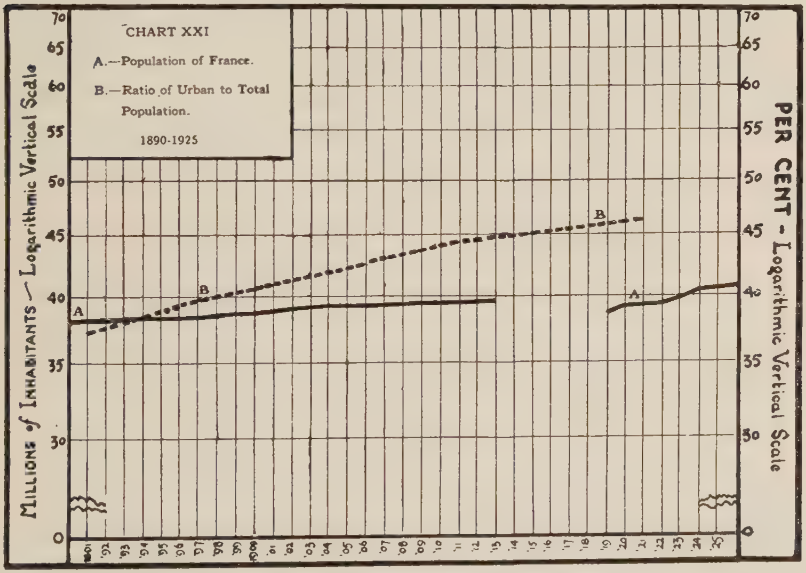
CHART XXI

A.—Population of France.

B.—Ratio of Urban to Total Population.

1890-1925

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[15] *Le Temps*, December 30, 1926.

fed tends to increase. Unless there are compensating improvements in the technique of agriculture, it becomes necessary to import the food. Consequently another measure of the relative growth of industry as compared with agriculture is to be found in increases in the per capita importation of foodstuffs.

The value of this index has certain very distinct limitations. First of all, the annual quantity of foodstuffs imported is a factor not only of the general insufficiency of French agricultural production, but of unstable atmospheric conditions. Thus if in a given year France had too much rain or suffered from drought, food imports were bound to increase. On the whole, the weather was rather favorable to French agriculture in the years following the war. Another consideration to be borne in mind is that the post-war years found France with a depreciated currency, hence paying dearly for all imports. This fact, too, operated to restrict purchases of foodstuffs abroad.

During the five-year period which immediately preceded the war, the average annual per capita imports of foodstuffs amounted to .119 tons. In spite of the favorable natural condition of domestic agricultural production in post-war France, in spite of the fall of the franc which tended to discourage imports, in every year from 1919 to 1926, with the sole exception of 1921, the per capita food imports were higher than before the war:

Year	*Per capita importation of foodstuffs into France (In metric tons)*
1909–1913 (average)	.119
1919	.180
1920	.158
1921	.109
1922	.129
1923	.143
1924	.141
1925	.127
1926	.124

In the course of the decade which preceded 1909, the average annual imports varied between .06 and .08 tons per capita.[16] The high records maintained during the post-war period are thus seen to be an unmistakable indication of a definite decline in agriculture, and consequently of the greater dependence of France on foreign countries for agricultural products.

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[16] See Appendix D, p. 592.

That the increased imports of foodstuffs after the war were due, in part at least, to the literal desertion of French fields is seen beyond question in the comparative statistics of the area under cultivation. In 1912 and 1913, there were 3.7 million hectares in France lying uncultivated, and in 1923 and 1924 this area amounted to 4.7 million hectares, representing an increase of 26 per cent. The cultivated land on the eve of the war was estimated at 23.7 million hectares in France without Alsace-Lorraine. In 1923–1924, the cultivated area, even including Alsace-Lorraine, was almost 5 per cent less, covering 22.6 million hectares. Furthermore, with the proportion of arable land converted into meadows, pastures and forests constantly rising, while the part tilled for cereals diminished, the acreage devoted to foodstuffs in post-war France was clearly on the decline — necessitating greater imports.

The increase in food imports was, however, of twofold origin: a diminished domestic agricultural yield, and an increased demand on the part of growing industrial agglomerations. This is evident from the fact that in the post-war period the proportion of food imported to food produced on French soil remained steadily very much above the pre-war proportions:

Year	*Ratio of the weight of net imports of cereals to domestic production of cereals*[17]
1908–1912 (average)	7.9%
1920	22.0
1921	15.7
1922	11.9
1923	13.1
1924	12.9
1925	10.7

[17] The importation figures used were moving averages — centered on the year concerned and averaged with the preceding and following year.

In the period from 1890 to 1908 the imports of cereals represented generally 5, 6 and 7 per cent of domestic production, only occasionally rising as high as 10 and 12 per cent. What was true of all cereals was equally true of wheat in particular. As for potatoes, France used to export them regularly before the war, but after the war she had to import them during most years. Thus the part that imported agricultural products played in the total consumed by the people in post-war France was considerably larger than it had been in pre-war years.

Further evidence of the fact that as industry expanded it encroached more and more on the position once held by agriculture is seen in the diminishing proportion of foodstuffs to the total foreign trade of France:

Year	*Ratio of the value of imported and exported foodstuffs to the total foreign trade of France*
1909–1913 (average)	18.0%
1919	25.0
1920	18.9
1921	20.2
1922	16.8
1923	16.8
1924	15.9
1925	14.0
1926	14.0
1927	17.8

Ship-holds and freight cars destined for France or leaving France for foreign lands were thus tending in the post-war years to devote a smaller part of their space to foodstuffs and a larger part to manufactured products and materials necessary for industry than they did before the war. This movement was, in fact, a continuation of a long-cycle trend, for in the last years of the nineteenth century the proportion of the value of foodstuffs to the total value of exports and imports ranged around 24 and 25 per cent. The temporary retrogression noted in the years 1919 to 1921 was

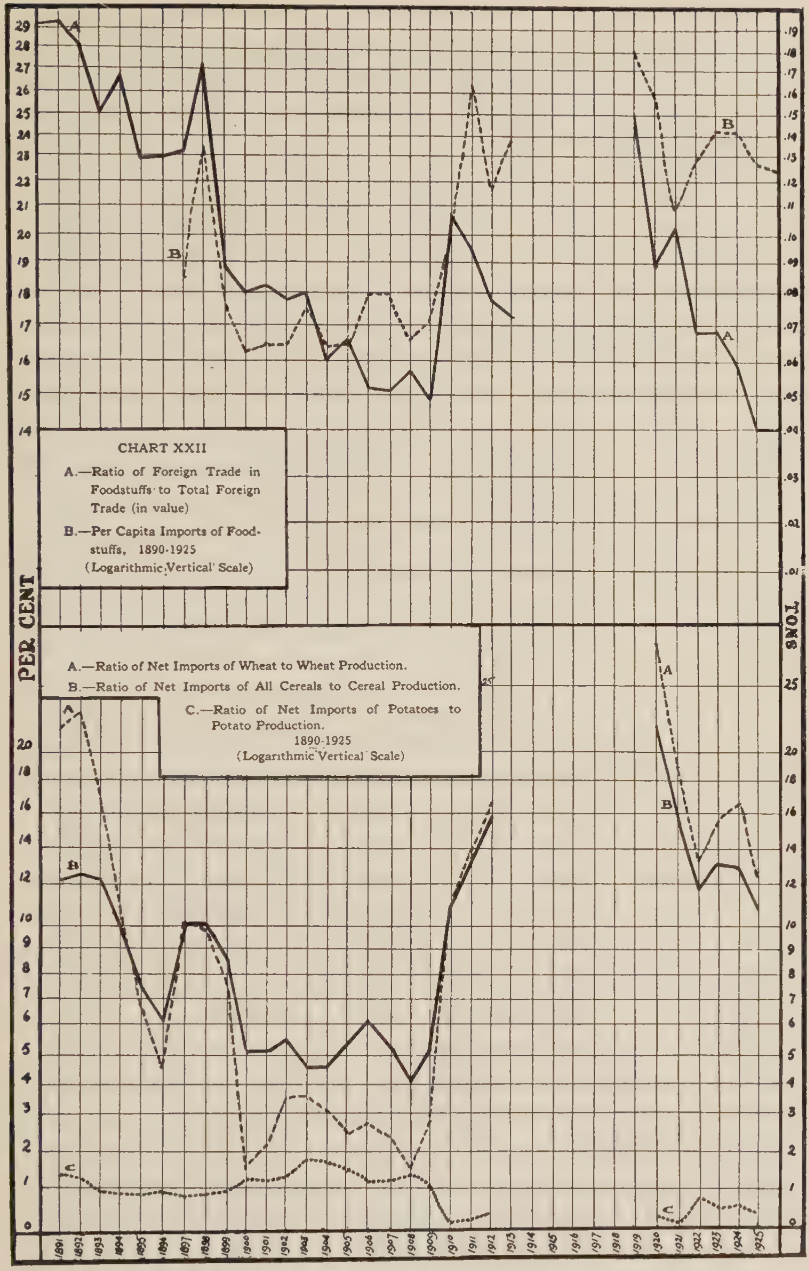

CHART XXII

A.—Ratio of Foreign Trade in Foodstuffs to Total Foreign Trade (in value)

B.—Per Capita Imports of Foodstuffs, 1890-1925

(Logarithmic Vertical Scale)

A.—Ratio of Net Imports of Wheat to Wheat Production.

B.—Ratio of Net Imports of All Cereals to Cereal Production.

C.—Ratio of Net Imports of Potatoes to Potato Production.

1890-1925

(Logarithmic Vertical Scale)

obviously due to the time required for reconstructing industry in the north and to the business depression in the last year of this period. Thus although France had to import more food after the war than before, yet her trade in industrial materials grew even more rapidly.

All these indices of the comparative development of agriculture and industry show that the relative intensification of industry was greater after the war than before. Nor was this wholly due to the addition of Alsace-Lorraine. For example, it was observed that the acreage of land uncultivated in France increased after the war, even though Alsace and Lorraine were added. In other words, within the bounds of smaller France the decline in agriculture from 1913 to 1923 must have been even greater than the official figures indicate, for they compare the disparate territories of pre-war and post-war France. Nevertheless the industrialization of France, when measured not negatively by the wane of agriculture, but positively by the expansion of manufacturing, undoubtedly owes a great deal to the reannexed provinces.

3. International Comparisons

The various indices considered above confirm the general impression already derived from the statistics of production, that France made a very notable advance in industrialization in the course of the seven years that followed the war. The French economic achievements are particularly striking when comparisons are made between pre-war France without Alsace-Lorraine and post-war France enlarged by this intensely industrial region. Nevertheless, as no nation lives economically *in vacuo*, but each moves forward in the atmosphere of progress to which all contribute, the true import of French post-war industrial development can be seen only in the light of the accomplishments of others.

Great Britain's record of industrialization after the war was far from brilliant. Both her total consumption and her per capita consumption of coal never, in any of the post-war years, recovered the 1913 level, while in France, it will be recalled, the per capita consumption in 1925 was considerably higher than in 1913 — or

France is not so bad as [illegible]

was, at least, the same if Alsace-Lorraine be included in pre-war France for purposes of comparison. The British per capita consumption of iron and steel in 1925 was 15 per cent below that of 1913, a fact that stands in strong contrast with the 35 per cent rise in France in the same years.[18] Even in Great Britain the ratio of exported manufactured goods to total exports rose from 1913 to 1925 by about 5 per cent, but that was a considerably smaller increase than the one which took place in France. The proportion of manufactured imports to total British imports was about the same in the post-war years as in 1913, while in France a notable decrease took place. Moreover, the foreign trade statistics of Great Britain show that foodstuffs play a slightly larger part in exports and imports than they did before the war — which is again diametrically opposed to the French experiences. It would seem, therefore, from these few indications that industrialization had not made the same progress in Great Britain after the war as it did in France.

Germany was shorn of so much of her former industrial territory after the war, that comparisons of her achievements with those of France are of doubtful significance. The per capita consumption of coal in Germany declined from 2.6 tons in 1913 to 2.2 tons in 1925. Moreover, in the same interval the per capita consumption of iron and steel fell by nearly 25 per cent.[19] On the other hand, the ratio of manufactured goods exported to the total German exports increased more than they did in France, but this is somewhat counterbalanced by the fact that the ratio of manufactured imports into Germany rose too. From the point of view of the relative development of industry and agriculture, the greater dependence of Germany on foreign countries for foodstuffs after the war would indicate some progress in industrialization. At the same time, however, there was a slight diminution in the ratio of the value of materials and articles of manufacture exported and imported to the value of the total German foreign trade. With the exception of Germany's greater dependence on imports for foodstuffs, there was no evidence of notable post-war industrialization in Germany, such as was found in France.

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[18] League of Nations, *Memorandum on the Iron and Steel Industry*, p. 33. The method of computing the estimates of iron and steel consumption for international comparisons differs from that used above (p. 190, note 4) in that no consideration is taken of the net exports of manufactured steel objects, such as machines, boilers, etc.

[19] *Ibid.*

It has already been observed that the natural situation and the economic history of the United States are so vastly different from those of France as to make comparisons extremely difficult. Nevertheless it is interesting to note that most of the industrializing tendencies of the United States from 1913 to 1925 find their parallel in France. In fact the per capita consumption of coal in the United States actually diminished from pre-war to post-war years, but the total quantity of coal consumed increased. There was a 25 per cent rise in the per capita consumption of iron and steel from 1913 to 1925, which was not as great as the French increase in this respect. Even with regard to the declining ratio of the value of imported manufactured goods to the value of all imports, the index of industrialization was more accentuated in France than in the United States. The proportion of manufactured goods to total imports, however, did not increase as much in France as in the United States. Both countries were becoming more dependent on foodstuffs from abroad, and both found that materials and articles of manufacture were assuming greater proportions in their total foreign trade.

Italy and Spain also made important industrial progress after the war, but they were seriously handicapped by an almost complete absence of coal. France, which ranks among the great coal producing and coal consuming countries of the world, showed a more rapid rate of industrialization from 1913 to 1925 than either Great Britain or Germany, and about the same rate as the United States. There was, however, much in this post-war progress of France that consisted simply in catching up with the status which these countries had already attained before the war, when France was industrially hibernating, as it were.

Summary

The post-war industrial progress of France was obviously stupendous, but was it really great enough to constitute a second "industrial revolution"? Whatever social changes took place in France after the war can scarcely be taken as evidence of such a "revolution," for they were, in reality, tardy social consequences of earlier economic transformations. It may, then, be asked whether, in post-war France, the industrial events themselves — regardless of their social effects — were such as to attest to a radical break with the past and to the beginning of a new industrial era.

An attempt to answer this last question was made through the examination of several different indices of industrialization. It was found that from 1919 to 1926 the advance in industrialization in France was rapid and far-reaching from every point of view. In the curves which accompany the discussion of each particular index, the slopes of the post-war sections, being extremely precipitous, have apparently nothing in common with the gently rising pre-war trends. This would betoken a veritable new departure, were it not for the fact that the sharp upward slant after 1919 was due to the terribly depressed condition of industry in France immediately after the war.

If comparisons be made between the higher post-war indices and the levels attained immediately preceding the war, then it is seen that France was indeed more advanced industrially in the later post-war years than before the war. The difference, however, is by no means large enough to justify any assertion of a second "industrial revolution." Indeed most of the late post-war indices were only slightly higher than those of 1913. Moreover, there were circumstances which might explain this difference as arising from causes other than a permanent intensification of industrial activity.

First among these circumstances was the inflation of the currency. As has been seen in previous chapters, the increase in the quantity of francs from which the public was taking flight undoubtedly resulted in a stimulation of sales of commodities, and consequently in increased production. There is room for suspicion, therefore, that the post-war indices of industrialization were temporarily forced beyond normal development by inflation. Industrial progress must certainly have been more or less encouraged by the monetary disorder, but it is difficult to tell without sufficient perspective, which will come only with time, whether this development was spurious and short-lived or real and enduring.

Another disconcerting circumstance which tends to obscure the significance of indices of industrialization in France is the reannexation of Alsace-Lorraine. In general, the pre-war indices were based on the achievements of France without Alsace-Lorraine, while the post-war indices measured the industrial accomplishments of greater France, including Alsace-Lorraine. Comparisons between these two different types of indices are nevertheless justifiable as showing the progress of France, taken as a nation, regardless of variations in her territory. The fact remains, however, that the rise in several of the indices of industrialization was due simply and solely to the addition of Alsace-Lorraine. For example, in the case of the coal consumption index, there was no gain at all from the pre-war to the post-war period, when Alsace-Lorraine was included with pre-war France in the comparison.

What was seen to be true of post-war increases in production is also true of progress in industrialization: the advance appears to be prodigious only if attention is confined exclusively to the year-to-year records of the post-war period. Let one but look back to the progress achieved in the decades preceding the war, and the post-war industrial development of France loses much of its glamour. A mere unaccelerated continuation of most pre-war industrial trends of France, even without Alsace-Lorraine, might very conceivably have led to even higher levels of industrialization than were actually attained with Alsace-Lorraine in 1925 and 1926 — had there been no war. The only two manifestations of a really striking post-war change in the direction of greater industrialization are to be found in the indices of the place of manufactured goods in French foreign trade and in the indices of the relative decline of agriculture. The first, however, are peculiarly responsive to the influence of monetary inflation and may be of transient importance, and the second are only negative signs of industrialization.

International comparisons of progress in industrialization, if based exclusively on post-war observations, are also likely to be misleading. The fact that more advance was made in France than in England or Germany may be due simply to the fact that each of these countries started their post-war careers at different stages in the process — and France's stage was a low one to begin with. Indeed all estimates of the degree of industrialization attained by France vary according to the different types of comparisons made.

As to the future, the trend appears definitely upward. With new coal and iron resources, with vast reserves of water power as yet untapped, there is reason to look forward to a continuation of the process of industrialization.

PART II

CHAPTER IX

COAL

Power lies at the basis of all industrial development, and its main source is coal. So far as France is concerned, it has been seen in a general way that the lack of an adequate provision of this combustible mineral seriously hampered industrial progress. The pursuit of coal, moreover, was one of the fundamental considerations of the French Government in negotiating the Treaty of Versailles and in determining the post-war relations of France with her former enemies and other countries. A detailed examination of the French coal resources, past and present, of the possibility of increasing coal production, and of the dependence of France upon her neighbors in this respect will shed much light on the economic and industrial position of the country.

1. The French Coal Situation on the Eve of the War

The coal reserves of France on the eve of the war, it has been seen, were estimated at about 18 billion tons.[1] These resources were indeed small compared with those of Great Britain where there were about 190 billion tons, or with those of Germany where there were 423 billion tons, while the United States possessed an immeasurably larger quantity, approximately 3,839 billion tons, of which about a third, however, was lignite.[2] Austria-Hungary and European Russia each had about 60 billion tons. On the other hand, the French coal supply was larger than that of Belgium with 11 billion tons, or of Spain with 9 billion tons, or of Sweden, Holland and Italy whose resources were extremely small.

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[1] See above, p. 5.

[2] Source: Comité des Forges, *Circulaire No. 538*, April 17, 1914; and Léon Guillet, *Les Industries métallurgiques à l'avant-guerre*, pp. 41 and 42 — cited in Ministère du Commerce, *Rapport général sur l'Industrie française*, p. 12. Lignite has only about one-quarter of the calorific value of bituminous coal. It is usually translated into coal units at the rate of two-ninths.

Most of the coal deposits of Europe were fairly scattered, except those of England, of the Westphalia-Saar region, and of Silesia. The reserves at the intersection of the German, Belgian and French frontiers were estimated in 1913 at about 255 billion tons, of which some 214 billion tons were in the Ruhr basin and 17 billion in the Saar. Germany was no less fortunate in her portion of the Silesian coal beds, for the part which lay within her borders at that time amounted to about 165 billion tons, representing 85 per cent of the total Silesian deposits. These concentrated coal beds were naturally the most economical to exploit. Thus the pre-war industrial power of Europe, in so far as it was derived from coal, came for the most part from Great Britain, and western and eastern Germany.

In France, by far the richest veins were situated near the Belgian frontier and the northern sea coast. This basin, which was in reality a tail-end extension of the vast Westphalian coal fields, contained deposits said to be of about 12 billion tons. Other French coal fields were dispersed, the most important being found in the south center, in the valley of the Rhône, and near the sources of the Loire. The French mines contained very little anthracite as compared with their yield of bituminous coal. Although they were not easy to exploit, they were worked carefully and well. Lignite beds were often found in the neighborhood of the coal deposits, but their production amounted to no more than 2 or 3 per cent of the coal extracted.

Coal-reserve figures are more significant as indications of stores for future use than as measures of production. The average annual output in France during the three years from 1911 to 1913 was 40 million tons, to which should be added a quarter of a million tons of lignite. About 60 per cent of this production came from the départements of the Nord and Pas-de-Calais; the basin producing the second largest amount was that of the Loire with 9 per cent. Saône-et-Loire and Gard each produced 5 per cent. The remaining 21 per cent was scattered among other small basins.[3]

At the same time (1911–1913 average) Great Britain produced 278 million tons, Germany 193 million tons (including lignite in coal equivalents), and the United States 484 million tons. Among the countries producing less than France were Russia with 31 million tons, Belgium with 23 million tons, Spain with 4 million, while Italy's output was negligible.[4] Although these figures of coal production are of value for comparing the capacity of various nations to produce industrial power from coal, they do not take into account the size of the countries considered. If the above statistics of output of each country be divided by its estimated population for 1912, then the following figures of per capita production are obtained: Great Britain, 6.7 tons; United States, 5.0 tons; Belgium, 3.0 tons; Germany, 2.9 tons; and France, 1.0 ton.

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[3] Ministère du Commerce, *Rapport général sur l'Industrie française*, p. 12.

If France had been obliged, before the war, to rely solely on her own production of coal, her rank as an industrial power would have been quite low. In the pre-war years, all the countries of Europe, except Great Britain and Germany, consumed more coal than was mined within their territories. Great Britain was in an exceptional position, exporting particularly large quantities. France, on the other hand, consumed over 50 per cent more coal than she produced.

The comparative figures of coal production in France and in other countries on the eve of the war do not reveal what an effort France was making to ameliorate her position by enlarging her own output. A comparison of the average annual production for the years 1901–1903 with that of the years 1910–1913 shows an increase in France of about 25 per cent in the intervening decade. Meanwhile German coal production had risen 58 per cent. The less industrialized and the newer countries saw their output increase still more: 90 per cent in Russia, 87 per cent in Austria-Hungary and 67 per cent in the United States. In Great Britain, however, production had expanded only by 21 per cent, while in Belgium where the mines were old and very intensively worked there was no increase at all.

2. THE FRENCH COAL SITUATION AFTER THE WAR

During the war the French output of coal fell from 40 million tons a year to an amount varying between 20 and 29 million tons, the average decline being slightly over 40 per cent. This fall in production was largely the result of the occupation of the most important coal-mining region of France by the German army. No coal at all was procurable in the département of the Nord during the whole period of hostilities, while the output in Pas-de-Calais available to France was only about half its normal quantity. In endeavoring to compensate for these inevitable losses the French intensified production in their other coal fields and increased the yield there by about 10 or 15 per cent. The consequences of the occupation of the north of France were felt not only during hostilities, but afterwards as well, for the best mines were returned in a severely damaged condition, and it was several years before normal production was resumed. What added to the industrial distress of France during the war years was a reduction of about 15 per cent in coal imports.

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[4] *Annuaire Statistique, 1926*, p. 268.

The French output of coal during the first year after the Armistice was signed indicates to what extent this industry had been hurt by the war. In 1919 only 20 million tons, but a half of pre-war production, were extracted from the mines within the 1913 borders of France. If there had been no war, and if French production had continued to increase at the same rate as during the decade before 1914, the yield would have been around 45 million tons, instead of the 20 million tons that it actually was, so that the setback may be estimated at 55 per cent.

As a result of the Treaty of Versailles, however, the coal beds of Lorraine passed within French borders, and since these mines produced 2.5 million tons in 1919, the total output within the definitely French post-war territory amounted to 22.5 million tons. And this was not all the coal mined by France in that year, for the Saar mines were ceded to the French at least temporarily up to 1935.[5] If the 8.5 million tons produced by the Saar mines in 1919 be added to the rest of the French output, then a total of 31 million tons is attained, which is still 24 per cent short of the French pre-war production within 1913 boundaries, or 31 per cent short of what might perhaps have been produced in France in 1919 within pre-war frontiers if no war had intervened.

[5] See above, p. 32.

France, though badly crippled in her coal production immediately after the war as a result of the devastation in the north, was not the only country to suffer a contraction in output. That of Great Britain fell by 16 per cent from 1913 to 1919, while that of Germany with her changed frontiers[6] fell by 39 per cent. Belgium's production was 19 per cent less than before the war, while Russia's had declined by 73 per cent. In Spain and Italy, where production was extremely small, and where even proportionally large fluctuations involved only a few tons, the coal output had risen by 44 and 80 per cent respectively. In the United States, production in 1919 was 4 per cent higher than in pre-war years. These figures give some idea of the effect of hostilities not only on the coal-mining industries of different countries involved, but on their general economic status in 1919. Coal is so essential to modern industry that the European shortage as revealed by these figures was at that time a real menace to the welfare of the whole continent, and its consequences were acutely felt.

Changes in French Coal Reserves Due to the Treaty

Whatever may have been the immediate effects of hostilities on French production, France came out of the war enriched from the point of view of coal reserves, that is, of eventual production. In reannexed Lorraine lay an extension of the Saar coal beds, but the Lorraine resources have apparently never been separately calculated. In 1913 production in this territory amounted to 3.8 million tons, which represented nearly 10 per cent of the French pre-war output. Since the coal mined in Lorraine came to about 22 per cent of the total production of the whole Saar-Lorraine basin, if it be assumed that the reserves were proportional to production, then the reserves in reannexed Lorraine (département of Moselle) were probably between 3 and 4 billion tons. This means that France was in 1919 about 20 per cent richer in coal deposits than she had been before 1914.

Should the temporary cession of the Saar to France become final after the 1935 plebiscite, then France's coal reserves will have been about doubled as a result of the treaty of peace, for the total

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[6] The Saar territory was omitted from this calculation.

Saar-Lorraine basin is said to contain about 17 billion tons. If the inhabitants of the Saar should vote in 1935 to remain under the jurisdiction of the League of Nations, then France would retain her possession of the mines, and the Saar would still be in an economic and customs union with France. If, however, the Saar population should vote for a reunion with Germany, then Germany would probably take advantage of her right to repurchase the mines, and the French reserves would only be about 21 or 22 billion tons.

For the time being, that is up to 1935, France enjoys the additional production which the Saar mines yield. In the year before the war, the Saar-Lorraine output was 17 million tons, which represented over 40 per cent of the French production at that time.[7] Since France was then importing about 25 million tons, she should, on the basis of pre-war standards, find her import deficit reduced to 8 million tons. Such, however, was far from being the case, because the 3.8 million tons produced in Lorraine were insufficient for the requirements of Lorraine itself, and of the 13.2 million tons produced in the Saar about half was needed for the Saar industries. Thus very little of the newly acquired coal output was available for reducing French imports.

Post-War Coal Production

When the smoke of battle lifted and the French found 200 of the mine shafts in the north wrecked and flooded, the machinery smashed, and 95 per cent of the workers' dwellings damaged or destroyed,[8] it was estimated that it would take from 7 to 10 years to complete the repairs required and return to the pre-war level of production. The recovery, however, was not only much more rapid than was at first thought possible, but, at the end of the post-war period under survey, the mines were much more efficiently equipped than they had ever been before. There was a considerably wider use of pneumatic hammers and of mechanical perforating and cutting instruments; new types of steam boilers were replacing the old; electric power was employed to a much larger extent than ever before. In addition to ameliorating the mining process as such, the French coal operators followed the general world movement by annexing chemical plants to their mine shafts for the purpose of obtaining by-products from the coal extracted. Moreover the housing and living conditions of the workers were considerably improved.

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[7] Ministère du Commerce, *op. cit.*, pp. 13 and 17.

[8] See above, p. 20 and pp. 118–119.

It is not surprising, therefore, that the mines in Pas-de-Calais, for example, produced more coal in 1925 than in 1913. Immediately before the war the annual output was 20.6 million tons. In 1919 production had fallen to 35 per cent of this figure, but then rose gradually from that point until it reached 102.4 per cent in 1925, and 114.4 per cent in 1926. The mines in the département of the Nord also began to exceed their 1913 production from 1925 on: by 11.6 per cent in 1925 and by 24.3 per cent in 1926.[9] While there were some individual mines that were not up to their pre-war standard, the production of the northern coal fields of France, taken as a whole, may be said to have recovered by 1925 from the effects of the devastation wrought during the war.

The rate of rehabilitation of the coal industry within the French pre-war territorial limits is shown in the following table of index numbers:

Year	*Index numbers of coal production in France within pre-war boundaries*
1911–1913 (average)	100
1919	49
1920	55
1921	63
1922	69
1923	83
1924	98
1925	106
1926	117
1927	117

Thus in 1924 within the old boundaries coal production had just about recovered its pre-war level, whereas in 1925 and 1926 unprecedented quantities were extracted. The total French coal production after the war was, in reality, higher than is indicated above, because these calculations do not include the annual Lorraine output which amounted to over 5 million tons in 1925 and 1926. If this additional coal be taken into consideration, and the new output of greater France be compared with the French pre-war coal production (not including Lorraine), then it is seen that as early as 1924 the pre-war level was surpassed:

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[9] *Bulletin de la Statistique Générale de la France.*

Year	*Index numbers of coal production in post-war France*
1911–1913 (not including Lorraine)	100
1919 (including Lorraine)	55
1920 “ “	62
1921 “ “	72
1922 “ “	79
1923 “ “	95
1924 “ “	111
1925 “ “	119
1926 “ “	130
1927 “ “	131

In absolute figures the movement of French coal production is indicated in the following table:

Year	*Production of combustible minerals in France*[10] *(In millions of tons)*
1911 (not including Lorraine)	39.2
1912 “ “ “	41.1
1913 “ “ “	40.8
1919 (including Lorraine)	22.4
1920 “ “	25.3
1921 “ “	29.0
1922 “ “	31.9
1923 “ “	38.6
1924 “ “	45.0
1925 “ “	48.1
1926 “ “	52.5
1927 “ “	52.8

[10] *Annuaire Statistique, 1926*, p. 57. The 1926 and 1927 figures were taken from the *Bulletin de la Statistique Générale de la France.* The Saar was not included. Lignite

In fact, the French coal production of 1924 exceeded that of both pre-war France and Lorraine in 1913 when the combined output amounted to 44.6 million tons.

Neither Great Britain, nor Germany, nor even the United States, the three greatest coal powers of the world, could show a similar post-war record of increase over pre-war production. In Great Britain the peak of post-war production was reached in 1923 when the output was only about .7 per cent greater than during 1911–1913, while in 1925 it was 2 per cent less. The production of coal (not including lignite) in Germany in her diminished post-war territory was in 1926 about 83 per cent that of the pre-war output within her 1913 boundaries. The German production of lignite, however, increased enormously, so that in 1926, in spite of the loss of territory, the lignite output was 75 per cent greater than before the war, and in tonnage was nearly as high as that of coal. If lignite be converted into coal heat units,[11] and then added to the coal extracted in 1926, it is found that Germany's production of combustible minerals in that year was but 8.5 per cent below her average annual 1911–1913 production. In the United States the 1926 output was only 24 per cent higher than in the pre-war years, which was not equal to the 30 per cent increase in France in the same interval.[12]

Coal Consumption

However significant the advance in French production may have been in the post-war years, it did not bring about any reduction in coal imports. During the years 1911–1913 the net annual average imports amounted to 20.9 million tons while in 1926 they rose to 26.3 million tons, representing an increase of about 26 per cent.[13] This was the consequence of a rapid post-war growth in the French consumption of coal which is shown in the following table:

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production was added to that of bituminous and anthracite coal without being converted to terms of coal, but as the amount was small the error is slight.

[11] See above, p. 219, note 2.

[12] *Annuaire Statistique, 1926*, p. 268.

[13] *Ibid.*, p. 127.

Year	*Consumption of combustible minerals in France (In millions of tons)*
1911 (not including Alsace-Lorraine)	59.5
1912 " " " "	60.7
1913 " " " "	64.8
1919 (including Alsace-Lorraine)	45.6
1920 " " "	56.8
1921 " " "	51.3
1922 " " "	61.9
1923 " " "	69.5
1924 " " "	75.0
1925 " " "	75.6
1926 " " "	79.5

It was inevitable that imports should rise when the increase in consumption in 1926 over the average of the years 1911–1913 amounted to 29 per cent, which was almost the same as the increase in production in that interval.

Although it might, at first glance, be supposed that the need for coal was intensified in post-war France to the same degree that coal production was increased, it must be remembered that the consumption figures for 1911–1913 refer to the pre-war French territory only, while the statistics from 1919 on include Alsace-Lorraine. In other words the enlarged consumption after 1919 may have been due simply to the necessity of supplying Alsace-Lorraine with sufficient coal rather than to an extraordinary increase in the demand for coal within the pre-war French territories. It will be recalled that this region was highly industrialized, that metallurgy was particularly developed, expecially in its more basic coal-consuming phases, and that the textile industries were also important. Indeed in 1913 Alsace-Lorraine consumed 11.1 million tons of coal, that is 7.3 million tons more than the Lorraine beds produced in that year.[14] Thus from the point of view of coal the reacquisition of Alsace-Lorraine involved more liabilities than assets, and the fact that post-war France was consuming far more coal than pre-war France was largely due to the addition of industrial equipment that came with the reannexed territory.

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[14] Ministère du Commerce, *op. cit.*, Vol. II, p. 964.

Another way of looking at the problem of the production and consumption of coal is to compare the amount produced and the amount consumed in France and Alsace-Lorraine combined both before and after the war:

Year	*Coal production in France and Alsace-Lorraine (In millions of tons)*	*Coal consumption in France and Alsace-Lorraine (In millions of tons)*
1913	44.6	75.8
1926	52.5	79.5

The increase in production amounted to 17.5 per cent, while consumption rose only about 4.9 per cent. Thus it is seen that the output of the whole area of greater France came nearer to supplying domestic needs in 1926 (66 per cent) than in 1913 (59 per cent). The net imports of coal into France and Alsace-Lorraine, which probably amounted to 31 million tons in 1913, came to 26.3 million tons in 1926. If, therefore, France be considered as theoretically having always had Alsace-Lorraine within her frontiers, then it is clear that the increase in production of coal was greater than her increase in consumption, and therefore her reliance on imports diminished. If, on the other hand, pre-war and post-war France be compared without making any allowance for territorial changes, then French net imports of coal in 1926 appear considerably (10.3 per cent) greater than they were in 1913.

The French Coal Supply and Post-War Diplomatic Negotiations[15]

The French nation before the war had been thoroughly aware of the importance of coal in industrial development and of the great rôle coal plays in determining the economic power of different countries. She had long been keenly alive to the inadequacy of her supply, and her dependence on foreign sources was tragically impressed upon her during hostilities when most of her coal-producing territory was occupied by the enemy. It was, therefore, only natural that, when the Treaty of Versailles was under discussion, the coal situation should have occupied a very large place in the minds of French statesmen. And even after the Treaty was signed the Franco-German post-war relations turned very largely on coal.

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[15] The following discussion of coal with relation to the Treaty of Versailles and the post-war diplomatic negotiations follows mainly the work of Guy Greer, *The Ruhr-Lorraine Industrial Problem.* See also Vol. VII of this series, Parker Thomas Moon, *The Foreign Policies of France, 1918–1928* (New York, Columbia University Press, 1929).

It has already been seen that Germany was compelled to cede the coal mines of the Saar to the French State "as compensation for the destruction of the coal mines in the north of France and as part payment towards the total reparation due from Germany for the damage resulting from the war."[16] The Saar mines had already been taken over by the French just after the Armistice, and had been in their hands for some time when the Treaty was ratified in the beginning of 1920. This apparently premature seizure of the Saar mines was simply a consequence of the coal crisis which affected all of Europe, and France with special acuteness, immediately on the signing of the Armistice. With her mines in the north damaged, with her foreign sources of imported coal considerably diminished, with her newly acquired Lorraine blast furnaces and steel plants threatening to become idle for want of coke and coal, with the new and intense coal requirements which were making themselves felt immediately for reconstruction in the devastated north, France had to make every provision to ensure coal deliveries without delay even before the Treaty could be concluded. Not only were the Saar mines seized, but on December 25, 1918, the protocol of Luxemburg was signed, making temporary provisions — which proved to be only partially effective — for the resumption of the pre-war exchange of Ruhr coke for Lorraine iron ore.

By the terms of the Treaty of Versailles[17] Germany undertook to deliver to France 7 million tons of coal per year for 10 years, and also to ship, for a period not exceeding 10 years, an amount of coal equal to the difference between the pre-war production of the coal mines of the Nord and Pas-de-Calais and their production during the post-war decade. France and the other Allies were given the right to demand metallurgical coke instead of coal in the proportion of 3 tons of coke to 4 of coal.[18] All options were to be exercised under the control of the Reparations Commission which was endowed with rather wide powers with regard to determining the quantities and qualities for delivery, and which had authority to cancel orders if they interfered unduly with Germany's industrial requirements.[19] The total maximum reparation coal deliveries that could fall to the share of France in any one year was 27 million tons during the first 5 years and 15 million tons for the second 5 years. Germany had, moreover, to furnish Belgium with 8 million tons annually for 10 years, and Italy with an amount beginning with 4.5 million tons and increasing during a 10-year period to 8.5 million tons. The Reparations Commission could also order Germany to supply Luxemburg with coal to the amount of her pre-war consumption, which was over 3 million tons a year. The Commission was required to give 120 days' notice for all its orders.

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[16] *Treaty of Versailles*, article 45.

[17] *Treaty of Versailles*, Part VIII, Annex V, paragraph 2.

The story of the operation of the German coal deliveries, as ordained by the Treaty of Versailles, is a chronicle of wrangles, of demands followed by protestations, of failures to hand over the stipulated quantities, of coke requirements that were never met, and of industries faltering for the lack of fuel. When the Reparations Commission started work at the beginning of 1920, Germany had been delivering about .5 million tons of coal and coke a month. The organization committee of the Reparations Commission had demanded on August 31, 1919, in accordance with the terms of the Protocol of August 29, 1919, that Germany deliver 3.2 million tons in January 1920. After many protestations on the part of the Germans and prolonged negotiations, the Reparations Commission finally reduced the orders to 1,440,000 tons for April, 1,925,000 for May, 2,062,000 tons for June and 2,175,000 for July of 1920, these figures being apparently more in harmony with the Protocol of August 29. The actual deliveries however began with 536,000 tons in April and 1,123,000 tons in May, to decline again to 1,088,000 tons in June.[20] These shipments to all the Allies amounted to less than the monthly loss of output in the devastated mines of France alone. The French Government therefore requested the Reparations Commission to declare Germany in default. The Germans protested that they were already handing over so much coal that it prevented their industries from recovering sufficiently to enable them to meet their other reparation obligations. They argued also that they had not been allowed the 120 days' notice. The Commission, on the other hand, declared on June 30, 1920, that Germany had failed entirely to live up to what was demanded of her, and that her own fuel needs were far better provided for than were those of France, Belgium or Italy. Germany was, therefore, reported in default.

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[18] *Ibid.*, paragraph 7.

[19] *Ibid.*, paragraph 10.

[20] Guy Greer, *op. cit.*, pp. 120–129.

A conference was then held by the Supreme Council of the Allies in July 1920 at Spa, to which German representatives were summoned. The Allies demanded that 12 million tons of coal be delivered during six months commencing August 1, 1920. In case of further default Germany was threatened with the occupation of the Ruhr or of some other part of German territory. In order to provide food for the German miners, the Allies agreed to pay 5 gold marks for every ton delivered. This agreement was carried out by both sides.

The fuel emergency lasted from the time the Armistice was signed until the close of the year 1920. It was so severe that every other consideration gave way before it. When, for example, the Germans put forward the argument that the coal was needed in Germany in order to produce goods to meet the reparations demands, the Allies seemed willing to postpone their claim for general reparation rather than forego coal deliveries. Even in 1920 all the principal Allied countries had very much less coal at their disposal than in 1913. In England the consumption was 95 per cent of what it had been before the war, in Belgium 81 per cent, in France 76 per cent and in Italy 55 per cent. Germany, whose 1920 consumption attained 88 per cent of the 1913 level, was thus better provided with combustible minerals than Belgium, France or Italy.[21] This was one of the reasons why so much pressure was put on Germany to increase the coal deliveries.

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[21] Guy Greer, *op. cit.*, p. 141.

England, endowed as she was with abundant fuel reserves, was naturally the first country to recover from the coal crisis, and she soon began to feel the need of foreign markets for her excess coal in a rehabilitated Europe. It was not long before she became aware of the necessity of reviving Germany as a purchasing nation. In 1921, with her coal strike settled, and her mines increasing in productivity, England found that her coal stocks were beginning to accumulate beyond what was necessary for domestic consumption, and she consequently sought buyers abroad. This quest was not altogether easy, for the fuel emergency on the Continent began to subside in that year, largely owing to the business depression which meant a diminished industrial demand for coal.

It was, in fact, the improved English situation which was largely responsible for easing the French coal crisis after 1920. The government control of imports and prices in France inaugurated during the war was abandoned in 1920 so that French buyers could freely turn to England for coal supplies. British coal was preferred to domestic or German coal because it was of better quality and often cheaper to procure. Much of the best English coal lay close to the sea, so that the cost of transporting it to the ports on the western and southern shores of France was relatively low. As the principal French mines were situated at the northern and north-eastern extremities of France, they were practically as far away as England from the western and southern French industrial centers — and sometimes even more distant, from the point of view of transportation costs. England was becoming so solicitous in 1921 for coal trade on the Continent and made so determined an effort to recover it, that in that year some of the less profitable mines in northern France found difficulty in selling their products. This makes it clear that the fuel emergency (aside from coke) had subsided in France.

Germany's position with regard to combustible minerals was very different in 1921 from Great Britain's. In the first place, German industries were little affected by the wave of business depression sweeping the world at that time, being saved no doubt by the depreciation of the mark. Consequently she had a large internal demand for coal and coke and had relatively less to export.

Furthermore in 1922 the coal beds of Upper Silesia were partitioned as a result of the plebiscite, and a large part passed to Poland. Thus the German industries in the east, which were dependent on coal from Upper Silesia, had to import it from Poland. The German Government therefore continued its protestations that it could not fulfill the demands of the Reparations Commission because more coal was needed at home than was being produced within the new diminished boundaries. This claim was further borne out by the fact that Germany had to import 8 million tons of coal from England in 1922, though it must be added that Germany had been in the habit of importing from England some 10 million tons every year before the war.

In the course of the year 1921 the Reparations Commission demanded 22 million tons for the Allies, and the Germans actually delivered 18 million tons or 82 per cent of the demands. In 1922 the situation was about the same: 21.7 million tons were demanded and 17.2 million tons were delivered.[22] These deliveries were rendered difficult because of the demand for reparation payments in general, as distinct from coal. In the beginning of 1921 Germany was required to make huge money payments to the Allies, so that she was faced with the necessity of building up a favorable foreign trade balance of first magnitude. This necessitated increased industrial production for which an increased consumption of coal was indispensable, and, of course, the extensive deliveries of reparations coal interfered with the successful pursuance of this program.

Indirectly, too, the coal deliveries acted as a hindrance to the establishment of an adequate trade balance which would permit Germany to acquit herself of her reparation payments in gold. When in 1921 the Spa arrangement, according to which the Allies paid 5 gold marks for every ton of reparations coal delivered, came to an end, then no money at all came into Germany as a counterpart for the vast quantities of coal sent out in lieu of reparations. Normally these deliveries would have constituted exports and the price received would have gone to pay any obligations Germany had abroad. In fact, whatever real foreign trade in coal there actually was militated against a favorable trade balance, for Germany had to pay for the imports of coal from England and from Poland. The reparation deliveries of coal were obviously working against the payment of other reparations.

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[22] Guy Greer, *op. cit.*, p. 156.

When it is said that the French fuel emergency passed after 1920, a distinction should be made between coal and coke. This latter substance, which is obtained by strongly heating coal out of contact with air until the volatile constituents are driven off, was indispensable to the metallurgical industries of Lorraine; and the only coal within a reasonable distance yielding the kind of coke suitable for blast-furnaces was that of the Ruhr in Germany. Since the need for this metallurgical coke in France was still extremely acute even after 1920, the French vigorously maintained that the Germans were not furnishing an adequate supply of it for the Lorraine industries, though large quantities were being produced in Germany. It is true that from 1919 to the end of 1922 the annual shipments of Ruhr coke into Lorraine were absolutely smaller and also constituted a smaller percentage of German production than in 1913.[23] The Germans, on the other hand, contended that they were converting a larger proportion of their coal production into coke because they needed the by-products — benzol, ammonia and tar — and because they required the coke as ordinary fuel to be used even for railways, since they were themselves suffering from a coal shortage.

By this time the coal question had produced a divergence of interests between France and England, the latter having suffered even more acutely than the continental countries from the 1921 depression. When the 1920 fuel emergency was over, England met with increasing difficulty in disposing of her surplus coal because the Central European markets had not yet recovered from the war. In the pre-war years (1909–1913) England sold annually some 11 million tons of coal to France, 9 million tons to Germany, 9 million to Italy, and 27 million to the rest of Europe.[24] Moreover, as her other exports were seeking outlets in vain, England was keenly interested in the economic improvement of Germany, her largest prewar customer. She could not therefore sympathize with France's draconian attitude towards Germany, though she was at the same time desirous of maintaining and increasing her sales of coal to France.

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[23] Guy Greer, *op. cit.*, pp. 164–166.

[24] League of Nations, *Memorandum on Coal*, Vol. I, p. 67.

The French were irritated not only by the failure of Germany to furnish them with sufficient coke — indeed, the pressure for coal and coke was less in 1921 and 1922 than in 1920 — but also, and even to a greater degree, by Germany's non-fulfillment of her other reparation obligations which brought France to a serious budgetary and financial pass. In the autumn of 1922 Germany was granted a temporary moratorium on her cash payments for a second time, and the future looked very dark indeed for such countries as France and Belgium which counted on this money for balancing public income and expenditures. In January 1923, at the request of the French Government, Germany was declared in default on timber, coke and coal deliveries. The French troops proceeded to occupy the Ruhr.

It was not at all certain that the invasion of the Ruhr was simply the outcome of the German failure to deliver the required quantities of timber, coal and coke. That was undoubtedly a contributive factor which served very well as a pretext to conceal other more urgent causes. Furthermore it was very questionable whether this occupation would increase immediate, or even eventual, shipments of combustible minerals from the Ruhr to Lorraine. The more fundamental motives were probably political, bearing principally on the problem of security; and there were also financial considerations, which did not lack a marked political color, since the French Government at that time built a large part of its budget on theoretical reparation claims.[25]

The effect of the occupation of the Ruhr was very similar to that of a coal strike. The average monthly production, which in 1922 had been 8 thousand tons of coal and 2 thousand tons of coke, fell to 1.6 thousand tons of coal and less than .3 thousand tons of coke in August 1923. Consequently much less coal and coke was delivered. The shipments in 1923, during the first half of which there was a strike in the Ruhr district, amounted to but 40 per cent of the 1922 shipments.[26] Toward the end of 1923 production and deliveries both increased, and with the subsequent improvement of relations between Germany and France, the coal and coke question gradually subsided into the background. On August 16, 1924, a new agreement was signed, known as the Protocol of London, by which the coal deliveries under the reparation clauses of the Treaty of Versailles were to be controlled by a mixed committee representative of both the Reparations Commission and the German Government instead of the Reparations Commission alone.

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[25] *Cf.* Robert M. Haig, *op. cit.*

[26] Guy Greer, *op. cit.*, p. 196.

Sources of Coal Imports into France

In the years immediately preceding the war France imported her coke and coal chiefly from England and Germany. During the period from 1911 to 1913, England supplied 43 per cent of the French imports, Germany 30 per cent, and Belgium 22 per cent.[27] These figures refer only to pre-war territory and do not include coal shipped into Alsace-Lorraine. It has already been observed that the reannexed départements produced only about a third of the combustible minerals they consumed, and that the deficit was filled principally by deliveries from the Ruhr and the Saar. Of the coal and coke purchased by France and Alsace-Lorraine combined in 1913, 43 per cent came from Germany, 37 per cent from England, and 16 per cent from Belgium.[28]

How do these percentages compare with those of the post-war period? Was greater France, with her reannexed regions, more or less dependent on Germany than she had been? Was she more or less dependent on England? In 1925 France received 33 per cent of her imported coal from England, only 3 per cent less than in 1913.[29] Belgium, on the other hand, was furnishing a considerably smaller proportion: 10 per cent in 1925 as compared with 16 per cent in 1913; and Germany and the Saar combined sent 51 per cent in 1925, which would indicate that France was more dependent on German-Saar imports than she had been before 1914. From Germany alone, as distinct from the Saar, France received but 36 per cent of her imports, so that the degree to which France may be said to be tributary to Germany for coal imports depends upon whether the Saar may be regarded as a part of France or whether that region will be reunited with Germany in 1935. Whatever the final political disposal of the various coal beds may be, it is quite clear that France must continue to cover the deficit of production on what is indisputably her own soil by imports from Germany, England, Belgium and the Saar. This is inevitable, given the location of the coal deposits in Western and Central Europe. The English coal basins bordering on the sea, the vast Westphalian reserves just across the Rhine, the smaller coal fields of the Saar, and the Belgian mines, all are within easy and economical transportation distance from the various points in France where coal is most needed.

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[27] League of Nations, *Memorandum on Coal*, Vol. I, pp. 60–61.

[28] Guy Greer, *op. cit.*, p. 69.

[29] League of Nations, *Memorandum on Coal*, Vol. II, p. 48.

3. Organization in the Coal Industry

Both before and after the war the coal industry of France was concentrated in the hands of a few large concerns. In 1913 over 50 per cent of the total French output was produced by 11 companies.[30] Although the different firms maintained themselves as business entities entirely independent of each other, they formed organizations in the various mining regions for the purpose of studying market conditions and performing general advisory functions. These are affiliated with a strong national organization known as the *Comité Central des Houillères de France*, which not only collects trade data of interest to its members but also advises on questions of general public policy. It represents the industry as a whole in its relation to the French Government, when any lobbying needs to be done regarding tariffs, labor, laws, etc. Neither the local associations nor the *Comité Central* attempt to handle sales or to apportion production. There are, indeed, no common selling agencies for coal in France, comparable with the German cartels or with the French steel *comptoirs*. The local associations merely endeavor to adjust commercial policies to changing market conditions. On the other hand, the fact that a few important steel companies possess large holdings of coal shares constitutes a very strong element of cohesion and stability. Since the steel industry is more centralized and more closely syndicated, its financial interest in coal has a tendency to coördinate the whole coal industry.

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[30] Cahill, *Report on the Economic Conditions in France, 1923*, p. 44.

4. The Future of France's Coal Production

When it is recalled that France produced in 1925 63.5 per cent of the coal she consumed, and in 1926, 66 per cent, the question arises: will France continue to be dependent on foreign sources for her coal, or is it possible that she may become more self-reliant in the near future? Though the increase in production in the latter post-war years appears to be very encouraging from the point of view of French coal autonomy, it seems hardly likely that this expansion in output can go very much further. In 1919 it was estimated by the Ministry of Commerce that production in greater France might be extended to 51.5 million tons a year, representing an increase of 6.9 million tons over the pre-war output.[31] An annual increase of 5 million tons, it was predicted, could be obtained from the mines in the north, if the methods of extraction were properly improved. Another million tons was to come from new mines opened since the outbreak of the war, and about a million more from a better exploitation of the Lorraine coal beds. The actual production statistics of 1926 came to about 52.5 million tons, a million more than the supposedly optimistic predictions of 1919 foretold. Both in the north of France and in Lorraine the possibilities proved to be greater than were originally suspected.

The results attained in 1926, and even the slight increase in 1927 to 52.8 million tons, would hardly justify any prophecy that the rate of expansion realized during the post-war reconstruction years could go on indefinitely. Mr. Cahill estimated in 1925 that the probable maximum limit of the French coal output would be 55 million tons; and his guess was more or less based on a public statement made by the head of the *Comité Central des Houillères de France* in November 1924 to the effect that the annual production of France could not be pushed much beyond 50 million tons a year.[32] The reasons given for supposing that neither the rapid post-war rate of increase nor even the pre-war rate, which amounted to about 1.5 per cent a year, could continue for very long were principally that it would perhaps be imprudent to encroach further on the relatively small reserves, that coal extraction was becoming increasingly difficult and that owing to the geographical situation of the French coal fields a large part of France would always consume imported coal by reason of the difference in price between land and water transport.

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[31] Ministère du Commerce, *op. cit.*, Vol. I, p. 16.

[32] J. R. Cahill, *Report on the Economic and Industrial Conditions in France, 1925*, p. 82.

The amazing spurts in French coal production from the close of the war up to 1925 were undoubtedly due to the reconstruction of war-wrecked mines. The 9 per cent rise from 1925 to 1926, however, would seem to be attributable rather to the general stimulus given to production under conditions of monetary inflation.[33] This is borne out by the fact that while there was no absolute diminution in the French coal output in 1927 as compared with 1926, the increase was only .7 per cent. It was difficult to curb coal production once a certain momentum had been reached, though general market conditions in the spring and summer of 1927 far from justified the continuation of coal extraction on the 1926 scale, and much less on an increased scale. Stocks were piling up so rapidly that the French Government put a temporary embargo, which lasted but a few weeks, on the importation of English coal in order to keep the French mines going and the miners employed.

It is because of the confused monetary and market conditions in the latter post-war years — for the transition from inflation to stabilization constitutes as great a disturbance as inflation itself — that it is so difficult to determine what the normal French coal production in the immediate future may be. It seems hardly likely that it may descend below the 1926–1927 level, because coal is an intrinsic part of the general industrialization process which promises to go on for some time to come.[34] It is interesting to observe, moreover, that the increased rate of coal production was accompanied by an expansion in the hydraulic electric industry and by larger oil imports, as will be shown in the following chapter.

All of the above considerations of the future of French coal production have left the Saar entirely out of account. If this region be considered as part of France, then 13.7 million tons should be added to the French production of 1926 (52.5 million tons) and 13.6 million tons should be added to that of 1927 (52.8 million tons). The increase in the post-war Saar output was very slight in comparison with the 13.2 million tons produced there in 1913. It would appear that there is room for considerable future expansion in Saar production in view of the 13 billion tons of estimated reserves in the Saar, especially since France with some 18 billion tons of reserves was able to produce 41 million tons even under 1913 conditions. The final inclusion of the Saar in 1935 would, to be sure, add very considerably to France's future coal production, but it is extremely doubtful if even then the combined output would be adequate to cover the needs of both France and the Saar.

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[33] See above, Chapter VII.

[34] See above, Chap. VIII, pp. 186–187.

French Coal Requirements

Although it is difficult to predict what the future coal needs of France may be, there are numerous reasons why one may safely anticipate an increase. In the first place, inasmuch as coal consumption is a measure of industrialization, and as that process shows a likelihood of considerable intensification in the future, the French coal requirements may still expand enormously. The past per capita consumption of coal in France when compared with that of other industrial countries (see page 242) indicates that France has a long way to go before she attains the level of industrial progress reached byEngland or Germany.[35]

The causes of these fluctuations in per capita consumption from pre-war to post-war years were complex and varied. In some countries the change was due chiefly to a growth in population out of proportion with the increase in coal output. That was especially true of the United States. In other countries the change was the result mainly of modified industrial and trade conditions, as, for example, in England. In France and Germany, however, the principal cause of the differences between the 1913 and the 1925 per capita consumption was the change in boundaries. The rise in French consumption from 1.63 to 1.85 tons per capita was, as has

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[35] See above, Chap. VIII, pp. 186–188, 210–212.

Country	Per Capita Consumption of Coal[36] (In Tons)	
	1913	1925
United States	5.1	4.4
England	4.2	3.9
Belgium	3.5	3.9
Germany	2.6	2.2
France	1.6	1.9
Holland	1.6	1.6
Spain	.4	.4
Italy	.3	.3

already been observed, due for the most part to the reacquisition of Alsace-Lorraine with its heavy metallurgical industries and its highly developed textile mills. Even with this increase, France remained far behind the United States, England, Belgium and Germany. If France should one day be industrialized to the point of requiring as much coal per capita as England, assuming that the French population remained stationary around 40 million, she would need between 150 and 160 million tons per year instead of the 79.5 million tons consumed in 1926.

Another reason why one may predict an augmentation in French coal consumption is the existence of abundant resources of iron ore in France. Even in 1913 the French metallurgical industries absorbed 12.5 million tons, or 19.6 per cent of the total coal and coke consumption.[37] Since then, the reannexation of Alsace-Lorraine has led to a great increase in this proportion, for post-war France, having come into possession of half the iron ore resources of Europe found her potentialities for the production of iron and steel enormously expanded. The more France encourages the elaboration of the Lorraine ore at home, rather than its shipment out of Lorraine to the Ruhr for conversion into pig iron, steel, and iron and steel products, as was done before the war, the more coal she will need. In fact, the only limit to the increase of her consumption of coal for metallurgical purposes will be the difficulty of finding markets for the semi-manufactured and finished steel articles in the face of keen competition from England, Germany and the United States.

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[36] League of Nations, *Memorandum on Coal*, Vol. I, p. 12. Coke, briquettes and lignite were included in terms of coal. The 1925 figure for France differs slightly from that given by the League of Nations (1.8), because the more definitive figures (see *Annuaire Statistique, 1926*, p. 127) give a higher result.

[37] Ministère du Commerce, *op. cit.*, Vol. I, p. 13.

Moreover the expansion of industries other than metallurgical will undoubtedly result in an even more important demand for coal. In 1913 the various branches of manufacture, not including metallurgy, mines, railways and gas plants, required 19 million tons of coal, or 29 per cent of the total consumption. There are no available post-war statistics bearing on the same facts, but undoubtedly there was an increase in coal consumption quite proportional with the increase in general production, and this increase will continue, despite the incursions of oil and electricity, as long as French progress in manufacturing goes on.

There remains, of course, to consider the use of coal for domestic purposes. In view of the almost stationary population of France, increased consumption in the household is hardly to be anticipated. There has probably been little or no change from the pre-war proportion of the total coal consumption (19 per cent) which found its way into fireplaces, stoves, house furnaces, etc. Unless immigration swells the number of inhabitants, or French habits with regard to the use of coal change, little increase in demand along these lines is likely to occur.

Along with the estimate of future production considered above, the Ministry of Commerce in 1919 published an estimate of probable consumption of coal for the year 1930.[38] It was calculated that there would then be a demand for 88 million tons. In 1926 the actual consumption amounted to 79.5 million tons, which was nearly 5 per cent greater than the consumption in France (64.8 million tons) and Alsace-Lorraine (about 11.1 million tons) combined in 1913. Thus the predictions of the Ministry of Commerce seem on a fair way to fulfillment if not as early as 1930, at least in years not far distant.

The question may be raised, however, whether the consumption of coal in France in 1925 and 1926 can be taken as representative of a general trend, since French industrial activity was at that time stimulated by the inflation of the currency. If the franc had remained stable in purchasing power in the latter post-war years, neither general industrial production nor the consumption of coal would, in all probability, have been as great as it was. Nevertheless regardless of the fact that the extraordinary expansion in coal consumption in 1926 was due in large part to temporary and abnormal conditions, it appears that the record then established may not only be maintained but even surpassed. In 1927, a year commencing with a severe industrial depression, and characterized from beginning to end by *de facto* monetary stabilization, the production of coal increased, and, more than that, the net imports increased as well. Statistics as to fluctuations in stocks were not available for 1927 at the time of writing, nor were foreign trade figures available showing imports and exports of coal into France exclusive of the Saar, so that no consumption estimates comparable with those previously considered can be computed. Still from the data given below it will be seen that there was very probably no decline in coal consumption from 1926 to 1927:

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[38] Ministère du Commerce, *op. cit.*, Vol. I, p. 41.

YEAR	COAL PRODUCTION (In millions of tons)	NET IMPORTS OF COAL, COKE AND BRIQUETTES[39] INTO FRANCE INCLUDING THE SAAR (In millions of tons)
1925	48.1	19.4
1926	52.5	18.1
1927	52.8	19.8

Thus the French post-war situation was not analogous at all to that of Germany, where coal production declined by 10 per cent in the first stabilization year (1924) as compared with the average production in 1921 and 1922 under conditions of inflation, and where consumption of coal fell 18 per cent in the same interval.

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[39] Unconverted to terms of coal.

Conclusion

Undoubtedly the general long-period trend of coal consumption in France is upward. Even in a year like 1927, when there were months of apparent overproduction because factories and railways, suffering from a temporary slump, required less coal than usual, the net annual results show no evidence of a diminished demand. Even when *de facto* stabilization set in and French prices tended toward the international level — a circumstance which in other countries led to a severe contraction in coal consumption — neither domestic production nor net imports decreased in France. This striking fact certainly indicates that the growing consumption of coal in post-war France was part of a fundamental industrial expansion, rather than a mere ephemeral consequence of inflation.

It is very probable that the inadequacy of coal production in France to meet the increasing needs of industry may in the past have impeded the economic aggrandizement of the country, and that it may continue to do so to some extent in the future. Yet so long as France remains on good commerical and political terms with England and Germany her lack of an ample domestic supply of coal should not seriously hamper her industrial development, since the English and German mines are situated at convenient distances from French manufacturing centers. Indeed, with a production capacity for coal fairly limited to the maximum already attained, and with a consumption capacity almost indefinitely expansible, it seems that France will have to rely more and more in the future on an intimate coöperation with England and Germany. The only factor which points to a likelihood of any decrease in the dependence of France on coal imports for industrial power is the possible development of hydro-electric sources, which will be the subject of discussion in the following chapter.

CHAPTER X

OIL AND ELECTRICITY

Until comparatively recent years, industrial development in its modern aspects was thought of as dependent exclusively on coal. Other sources of power known at that time were coming to hold a less and less important place in production. The winds, for example, were being abandoned in favor of steam in mills for grinding wheat and in sea-going traffic. All over the world the proportion of trade carried by sailing vessels was constantly shrinking. The use of animal power, derived from horses and oxen, though not diminishing absolutely in many countries, declined relatively in comparison with the total volume of power utilized for productive purposes. Moreover the muscular effort demanded of human beings in factories and also on farms was smaller and less arduous wherever the steam engine had been introduced.

1. Oil as a Substitute for Coal

During the first quarter of the twentieth century a most spectacular change took place as a result of a series of epoch-making inventions which made petroleum oil a very effective source of power. Oil not only worked side by side with coal to reduce even more the rôle of wind and animal power, but it actually encroached on domains only recently conquered by coal. On the sea, for instance, oil came to be frequently burned as fuel instead of coal to generate steam, and also, with the adaption of combustion engines to marine purposes, products of the distillation of petroleum were increasingly resorted to as a direct source of power. The following table indicates the relative proportions of coal- and oil-burning steamships launched since the war:

PROPORTIONS OF COAL- AND OIL-BURNING STEAMSHIPS AND MOTOR-SHIPS LAUNCHED IN THE WORLD[1]

Period	Coal-Burning		Oil-Burning	
	Thousands of gross tons	Per cent	Thousands of gross tons	Per cent
1918–1919	2,491	66.2	1,270	33.8
1919–1920	2,111	50.4	2,076	49.6
1920–1921	1,260	39.0	1,969	61.0
1921–1922	895	35.5	1,622	64.5
1922–1923	663	41.1	948	58.9
1923–1924	468	53.5	406	46.5
1924–1925	671	51.2	640	48.8
1925–1926	419	36.1	906	68.4

In industry and agriculture, too, oil often replaced coal as a source of heat and power.

In spite of this amazingly rapid extension in the use of oil, it is extremely improbable that it will ever become a general substitute for coal, since the known oil resources of the world are very limited in comparison with the coal resources. In the United States, which is enormously rich in both fuels, the power embodied in the petroleum reserves is estimated at only .08 per cent of the coal power of the country which may eventually be used.[2] It is likely, therefore, that oil will be more or less restricted to uses for which coal is less well adapted, as for instance for combustion engines on means of transport over land and sea and through the air.

France, to be sure, participated in this general movement, although severely handicapped because she possessed so niggardly a share of the world's petroleum wells. Her consumption rose from an annual average of 506,000 tons in the four-year period immediately preceding the war to 1,290,000 tons in the 1923–1926 period.[3] The reannexation of Alsace-Lorraine accounted partly for this increase, but the chief cause was an intensified use of oil in factories, on farms and in transportation throughout the country. And this, despite the fact that domestic production was confined to the oil fields around Pechelbronn in Alsace whose post-war yield hardly ever exceeded 70,000 tons of crude oil, which represented about one-twentieth of one per cent of the world output. The 1926 production which amounted to 70,000 tons in terms of crude oil, when refined covered only 1.8 per cent of the French nation's requirements in that year.

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[1] *Lloyd's Register of Shipping*, cited in League of Nations, *Memorandum on Coal*, Vol. I, p. 8.

[2] *The World Almanac, 1927*, p. 305.

[3] *Annuaire Statistique, 1926*, p. 127.

It is improbable that the production of oil in Alsace will be increased to any great extent in the future. Nor are there any encouraging indications of the existence of oil in other parts of France, and the amount discovered in the colonies is insignificant. Therefore the further substitution of oil for coal would not relieve France from the necessity of depending upon foreign countries for a considerable proportion of the supply of fuel needed for the development of her industries. Still, this substitution continues in France, as everywhere else, because petroleum has frequently proved to be superior to coal as a source of power. In fact, the French fuel difficulties in the post-war period were aggravated by the increased use of oil, rather than alleviated, as the following table of imports shows:

Year	*Oil imports* [4] *(In thousands of tons)*
1913	553
1919	599
1920	815
1921	712
1922	888
1923	992
1924	1,211
1925	1,401
1926	1,338
1927	1,436

[4] Designated in French foreign trade statistics as "huiles minérales, brutes, raffinées et essences." The exports were insignificant.

2. Electricity

The only other source of power, besides coal and oil, of paramount importance to industry is electricity. Its potentialities far exceed those of oil, and perhaps even of coal. Its extended use to furnish motive force for production began less than fifty years ago, yet the progress achieved has been extremely rapid and dramatic. Each of the recent decades has been marked by a phenomenal development in the generation and utilization of electric current. What the future may hold in store can only be a subject of imaginative speculation. Already efforts are being made in France to obtain current from the movement of the tides. Because of its easy divisibility, electric power is giving rise — in the silk industry of Lyons, for example — to a revival of home industry with the aid of small dynamos. It may be that it will eventually bring about a general dissolution of the modern highly concentrated factory system with its overcrowded agglomerations of population and other attendant evils. Whatever may be the far distant rôle of electricity, it now constitutes an essential factor in the development of industry in France and the world over.

The Production of Carbo-Electricity

Electrical energy is mainly derived from two sources, from the force of a falling stream of water, or from the force of expanding steam, which in either case is made to propel a generator. In the latter case, the steam is derived from the energy stored in coal or lignite, so that electric current produced in this way may be called carbo-electricity in contradistinction to hydro-electricity, which is obtained by harnessing waterfalls.[5] While the use of carbo-electricity does not reduce the consumption of coal, it is nevertheless commonly resorted to because waterfalls are frequently too distant from the industrial centers where power is needed. In many cases it is cheaper to produce electricity from coal than from waterfalls, on account of the high initial cost of capital equipment needed for building hydro-electric plants.

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[5] The amounts of fuel oil, gasoline and blast-furnace or other gas used to generate electricity are very small in France.

The advantage of converting steam power into electricity rather than using it directly, as when a steam engine drives machinery, lies in the fact that electric current can be more easily subdivided, that it can be transported from the place where it is generated to the place where it is applied by a simple wire, that it is better adapted to run street cars and even railways, and that electrical energy may be transformed into light and sound whereas steam cannot. Carbo-electricity is not only applied where other forms of power could not serve the purpose or would be inconvenient; it is also used in what was once the domain of steam *par excellence*, in propelling industrial machinery. One of the main reasons for this change is the economy realized in the transmission of energy. When coal, through the medium of steam, is used directly in small steam engines of an older type, sometimes as much as nine-tenths of the fuel energy is lost. Furthermore the transportation of coal to all points where power is demanded involves the movement of enormous masses of bulky freight, which again requires power that might be saved if the energy in coal is first transformed into electricity and then carried to its destination over wires. Thus much coal is saved, and congestion of railway traffic is relieved.

The economy in energy is particularly marked when electricity is generated in the immediate vicinity of coal fields. Often the distribution of current is so organized through the interconnection of several producing centers in a common system, that accumulations of coal in times of slack demand in any one center are utilized to produce electricity for the entire region comprised within the system. The various possibilities of suppressing waste in coal consumption by such methods as these are certainly considerable, though they can only be estimated in each particular case rather than in any general fashion. The development of such "super-power" and "giant-power" schemes is especially important in countries endowed with the largest supplies of coal and lignite, like the United States, Germany and England.

Since France has a rather inadequate supply of coal resources, it is not to be expected that she should rival the three great coal nations of the world in the production of electricity. The United States, producing about 45 per cent of the world's supply of coal in 1925, naturally produced also about 40 per cent of the electric current generated in that year, while France, whose coal production represented barely 4 per cent of the world's output, produced only 6 per cent of the world's electricity.[6] If, however, comparisons are restricted to Europe, then France ranked third in 1925, coming after Germany and England in the production of electricity as in the production of coal. The following table, drawn up by the *Zentralverband der Deutschen Electrotechnischen Industrie* for the League of Nations shows the relative position of the different nations as producers of current, and gives an approximation of the amounts generated in 1925.

Country	*Electric energy generated in 1925*[7] *(in billion kilowatt hours)*
United States	65.8
Germany	22.0
Great Britain	11.0
Canada	10.5
5 France	9.8
Italy	7.6
Japan	6.7
Norway	6.2
Russia	4.1
Switzerland	3.9
Sweden	3.8
Other Countries	12.25
	163.65

Pre-war statistics are unfortunately not available for France, so that it is impossible to say how much progress has been made there since the war in comparison with 1913. In the United States the total amount of current generated by public-service power stations in 1912 was 11.6 billion kilowatt hours, or about one-sixth of what it was to become thirteen years later. It is interesting to observe also that the increase in the United States from 1919 on was more rapid for carbo-electric power (78 per cent from 1919 to 1925) than for hydro-electric power (53 per cent from 1919 to 1925).[8] In Germany, which also had to rely chiefly on coal and lignite since waterfalls were not very plentiful, the total production of electricity which came to 6 or 7 billion kilowatt hours in 1913 increased threefold or fourfold in the twelve years that followed. Despite the fact that Great Britain too had a relatively small supply of water power, there was nevertheless a great development of the electrical industry from 2 or 2.5 billion kilowatt hours to about five times that amount in 1925.[9]

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[6] League of Nations, *Memorandum on Coal*, Vol. I, p. 43.

[7] League of Nations, *Electrical Industry*, p. 40. Some of the data refer to 1923, 1924 and 1925–1926. Most estimates apply to all stations, but for the United States and Canada to public stations only. According to the monograph of the British Electrical and Allied Manufacturers' Association in the same publication (p. 85), production in Germany is given as 11.5 billion, in France as 9.7 billion and in Great Britain as 8.3 billion, but no explanation of these differences is offered.

The Production of Hydro-Electricity

Since France's total coal requirements exceeded her production by more than 50 per cent in the latter post-war years,[10] it was natural that she should be interested in the development of her water-power resources for generating electricity in order to reduce as far as possible her consumption of coal. The very terms used in France to indicate the various sources of hydraulic energy reveal the general feeling that hydro-electricity is a substitute for combustible minerals. Thus the electricity generated by waterfalls is known as *houille blanche* (white coal), by streams as *houille verte* (green coal), and by tides as *houille bleue* (blue coal). The emphasis placed in France on water power is seen in the fact that in 1923 the proportion of electricity produced in French hydro-electric stations was 45 per cent of the total,[11] whereas in that same year the United States generated only 35 per cent of its current by water power.[12] France is thus in a position not very different from that of Italy, Switzerland, Norway, and Sweden, where the coal supply is inadequate or totally wanting but where great watersheds exist which may compensate, in part at least, for the lack of coal.

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[8] *Statistical Abstract of the United States, 1925*, p. 354.

[9] League of Nations, *Electrical Industry*, p. 40.

[10] See above, pp. 226–228.

[11] Ministère des Travaux Publics, *Statistique de la Production et de la Distribution de l'Énergie électrique au 1er janvier 1925*, p. 62.

[12] *Statistical Abstract of the United States, 1925, loc. cit.*

A glance at the relief map of France reveals vast regions of high elevation in the southeast where the Alps are contiguous to Switzerland and Italy; and in the southwest where the Pyrenees rise between Spain and France; and also in the south center, west of the Rhône, where are the high plateaux of the Massif Central. It is to be observed that these natural regions of water power are advantageously situated away from the north and northeast where coal is abundant. The Vosges, the Jura Mountains and the Alps, that lie to the east and southeast of France, are estimated to contain between 6 and 7 million horse power of hydraulic energy at average flow, while in the Pyrenees and in the Massif Central there are said to be about 3 or 4 million average flow horse power.[13] Thus there is a rather evenly spread distribution of sources of power in France.

The potential French resources of hydraulic energy have been variously estimated at between 4.7 [14] and 5.4 [15] million horse power at low water stage, and at between 8 and 10 million horse power at average flow.[16] The low stage figures represent the volume and fall of water during the driest season when the amount of water flowing in the stream is at its lowest. This is the potential hydraulic power that can be relied on all the year round for the purpose of generating electricity. There is nothing fixed or stable about these estimates, for not only are natural conditions constantly changing the course and power of streams but man is building dams and reservoirs to raise the maximum energy derived under low water conditions. The average flow statistics are based upon the average power obtainable in all seasons, dry and rainy. The rainy seasons naturally vary in duration and in frequency in different countries and even in different parts of any large country, but in most regions of the world the flow of streams attains its maximum in the early spring when rivers are swollen by the melting snows and heavy rainfall.

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[13] Victor Sylvestre, *La Houille blanche*, p. 147.

[14] United States Geological Survey, *World Atlas of Commercial Geology*, Part II.

[15] U. S. Department of the Interior, *Developed and Potential Water Power of the World at the End of 1923* (Memorandum for the Press, March 31, 1925).

[16] Ministère du Commerce, *Rapport général sur l'Industrie française*, Vol. I, p. 17, and Victor Sylvestre, *op. cit.*, p. 157.

It is difficult to coördinate estimates of potential water power over vast regions; and in many countries, especially where industry is still in a rudimentary stage, statistics are hard to obtain. It is not surprising, therefore, that figures given in different publications show rather wide discrepancies. In the following table are presented two sets of estimates, one from the *World Atlas of Geography* published by the United States Geological Survey in 1921, and the other from a memorandum issued to the press by the United States Department of the Interior on March 31, 1925, giving a summary of the potential and developed water power in 1923. Both rows of figures represent the total power that could be obtained at ordinary low water:

POTENTIAL HYDRAULIC POWER AT LOW WATER STAGE IN EUROPE

(In thousands of horse power)

COUNTRY	*World Atlas of Commercial Geography* ESTIMATE, 1921	U. S. DEPARTMENT OF THE INTERIOR ESTIMATE, 1923
Norway	5,500	9,500
Russia (including Ukrainia and the Caucasus)	7,425	8,425
Sweden	4,500	8,000
France	4,700	5,400
Spain and Portugal	4,300	4,300
Italy	3,800	3,800
Switzerland	1,400	2,500
Yugoslavia	2,600	2,200
Germany	1,350	2,000
Finland	.....	1,800
Austria	3,000	1,660
Poland	200	1,400
Bulgaria	1,200	1,200
Rumania	1,100	1,100
Czechoslovakia	420	1,000
British Isles	585	850
Others	3,000	2,000
Approximate Total	45,000	57,000

Russia and Norway are the two countries of Europe most richly endowed with potential hydraulic energy. France according to one estimate is third in rank in this respect, and according to the other estimate is fourth, coming after Sweden as well as Russia and Norway. She is clearly far in advance of Germany and England, and is better supplied than Italy, Switzerland and the Iberian peninsula. Thus France, deficient in coal, holds a high position among the water-power countries of Europe. It would not be quite fair, in view of the great differences in area of the two countries, to compare France's hydraulic energy capacity with that of the United States, which is said to be between 28 and 35 million horse power.

During the post-war period France has made considerable progress in exploiting an increasing part of the potential water power with which she is endowed. Indeed the development of the hydro-electric industry has been one of the outstanding features of the industrial expansion of France since the war. It should be borne in mind, however, that France was by no means the only country enlarging her water-power plant capacity, for Italy, Norway, Sweden and Germany — to mention only European countries — were similarly engaged in expanding and ameliorating their means of utilizing their potential hydraulic energy. Switzerland had even before the war attained a high degree of efficiency in water-power development. Unfortunately, comparative international statistics, giving a quantitative statement of the progress made, are not available, since the standards of measurement used vary greatly from country to country, and what figures exist are often inadequately described. It is even difficult to obtain a comparable year-to-year record for France alone.

In 1906 the hydro-electric energy actually in service in France, measured in terms of the average flow of water developed, was, for all plants large and small, .77 million horse power.[17] At the beginning of the year 1925 the power employed, computed in the same way, came to 1.52 million[18] horse power, representing an increase of about 100 per cent in a little less than two decades. According to provisional figures communicated by the French Ministry of Public Works, the water power in service at normal flow on January 1, 1927, may be estimated at about 1.75 million horse power, which implies an average increase of about 115,000 horse power a year for 1925 and 1926. These post-war figures stand in interesting contrast with the probable million horse power which was developed on the eve of the war.[19]

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[17] Statistique Générale de la France, *Statistique des Forces motrices en 1906*, p. 28. This figure and the figures that follow do not include water works in the process of construction or in project. Nor do they represent the capacity of the machines installed, which is sometimes twice as great as the power utilized at normal flow. Purely provisional installations are excluded also. The French "cheval-vapeur" unit is taken as the rough equivalent of one horse power. See above, Chap. VIII, p. 194, note 6.

It was during the war, and particularly after 1915, that a striking development of the water-power industry took place in France, largely as the result of the acute shortage of fuel. There is, however, no official record of the progress achieved at that time, for the first reliable data published since the beginning of hostilities refer to the year 1922, when there were about 1.47 million horse power in service.[20] The total increase from the beginning of 1914 to January 1922 amounted, therefore, to about 45 per cent.

While, as has been noted, the total hydro-electric power in service in France on January 1, 1925, was 1.52 million horse power, the capacity of the machines installed at that time was much larger. Since there are seasons of the year when the flow of water is considerably greater than the average for the whole year, the size and equipment units of hydro-electric stations are usually planned with a view to utilizing the maximum water power available. Thus reserve machines are often installed in larger plants. This explains why in 1925, for example, the capacity of the hydro-electric machinery in stations of 1,000 kilowatts or more was nearly double that required by the average flow of water reaching such plants.[21]

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[18] Ministère des Travaux Publics, *Statistique de la Production et de la Distribution de l'Énergie électrique au 1er janvier, 1925*, p. 42. Kilowatts were converted into horse power at the rate of .746 KW = 1 HP.

[19] This estimate is based partly on a computation made by M. Fontaine (*L'Industrie française pendant la Guerre*, p. 140) who arrived at a figure of 570,000 horse power developed in hydro-electric plants of over 200 kilowatt capacity. He assumed that the average rate of increase in these larger plants was the same from 1906 to 1914 as from 1901 to 1906. The production of the hydro-electric stations of less than 200 kilowatt capacity may be roughly estimated at 470,000 horse power, since 427,000 horse power were generated in such plants in 1906 and 532,000 in 1925. By adding the production of the smaller and larger plants an estimate of 1.04 million horse power is reached for 1914.

[20] Arthur Fontaine, *L'Industrie française pendant la Guerre*, pp. 141–142. These figures are based on the *Liste des principales Usines hydro-électriques en Service, en Construction, en Projet au Mois de janvier 1922*, published by the Ministère des Travaux Publics. Only stations of over 200 kilowatt capacity were included in this list.

Thanks to the statistics of the *Chambre Syndicale des Forces Hydrauliques* it is possible to trace the annual growth of the power capacity of alternators coupled to turbines in French hydro-electric plants. The data published and communicated refer only to the alternators in stations of adherents of the *Chambre Syndicale*, but, according to M. Tochon, the director of this producers' organization, if 10 per cent be added *grosso modo* to each annual figure,

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The growth in the production of these larger plants (of over 200 kilowatt capacity) is shown in the following table:

YEAR	POWER PRODUCTION AT NORMAL WATER FLOW IN HYDRO-ELECTRIC STATIONS OF 200 KILOWATT CAPACITY AND MORE (In thousands of horse power)	SOURCE
1906	335	See above, p. 255, note 17.
1914	570	Estimated by Arthur Fontaine.
1922	844	Ministère des Travaux Publics, *Liste des principales Usines hydro-électriques etc.*
1925	988	See above, p. 256, note 18.
1926	1,040	Estimated from provisional figures communicated by the Ministère des Travaux Publics.
1927	1,120	

[21] Ministère des Travaux Publics, *Statistique de la Production et de la Distribution de l'Énergie électrique au 1er janvier 1925*, p. 42. The power capacity of machinery installed in plants of 1000 kilowatts or more was recorded January 1, 1925, as 1,263,200 kilowatts, whereas the average current generated in these plants amounted to 662,630 kilowatts. On January 1, 1927, according to provisional figures communicated by the Ministère des Travaux Publics, the machine capacity was 1,437,570 kilowatts, while the average current came to 758,900 kilowatts, again in plants of 1000 kilowatts or more. The custom has grown up of quoting statistics only of stations of 1000 kilowatts or more power capacity, in the first place because most of the recent development in electrical production took place in the larger plants, and in the second place because the smaller stations were too numerous to permit of frequent censuses, since there were, in 1925, 42,000 plants of less than 200 kilowatt capacity.

then a rough estimate may be obtained of the power capacity of all French hydro-electric stations of over 500 kilowatts.

YEAR	ESTIMATED HORSE POWER OF HYDRO-ELECTRIC STATIONS IN FRANCE OF OVER 500 KW. CAPACITY [22] (In thousands of horse power)	YEAR	ESTIMATED HORSE POWER OF HYDRO-ELECTRIC STATIONS IN FRANCE OF OVER 500 KW. CAPACITY (In thousands of horse power)
1903	251	1915	849
1904	276	1916	893
1905	292	1917	932
1906	332	1918	1,008
1907	376	1919	1,106
1908	466	1920	1,168
1909	524	1921	1,304
1910	640	1922	1,375
1911	673	1923	1,518
1912	711	1924	1,675
1913	759	1925	1,734
1914	818	1926	1,837

These figures indicate clearly the great development in the hydro-electric industry of France that took place during and after the war. From 1914 to 1918 there was an increase of a little over 23 per cent in the capacity of the generating machinery installed, and from 1919 to 1927 the growth amounted to 66 per cent. Whereas the annual rate of increase fluctuated between 5 and 8 per cent in the 1910–1913 period, after the war it attained at times 10 and 11.5 per cent. It is important to observe that the total hydro-electric machine-capacity in 1926 was considerably more than twice as great as that existing in France in 1913.

As a result of this incessant effort to extend the installations of water-power machinery, France, though holding third or fourth place in Europe with respect to the potential hydraulic energy at her disposal, was first among European nations with regard to the water power actually developed. This high rank of France is confirmed by the two sets of estimates presented below:

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[22] The figures from 1903 to 1923 inclusive were taken from G. Tochon, "Les Forces hydrauliques," in *Chimie et Industrie*, Vol. II, p. 10. The data for 1924, 1925 and 1926 were communicated by M. Tochon. The statistics originally given in terms of kilowatts were converted into horse power at the rate of 746 watts per horse power.

COUNTRY	ESTIMATED INSTALLED WATER-POWER CAPACITY[23] (In thousands of horse power)	
	World Atlas of Commercial Geography Estimate, 1921	U. S. Department of Interior Estimate, 1923
France	1,400	2,100
Norway	1,350	1,820
Italy	1,150	1,800
Switzerland	1,070	1,490
Sweden	1,200	1,416
Germany	1,000	1,100
Spain and Portugal	610	1,010
British Isles	210	250

The above data include presumably all plants, both large and small, although this is not explicitly stated in the sources. It is quite possible also that they may refer to stations in the process of erection or planned for immediate construction. That would explain the wide discrepancy between these figures and the annual hydro-electric plant capacity statistics given above. In any case these estimates are only very rough approximations.

The status attained by France in hydro-electric equipment is all the more remarkable because of the peculiar financial and technical difficulties with which the building of these stations was beset. The installation of water-power plants of the larger type involved enormous initial outlays of money. Indeed the interest charges on immobilized capital invested usually constituted the largest item in the cost of production of hydro-electric current. As vast sums of capital had first to be accumulated, and as much surveying and preliminary planning by engineers had to be carried out to a refined detail before any project could be put into actual operation, the construction of hydro-electric plants was often spread over a number of years. That is why appraisals of the hydro-electric equipment of a country often comprise, in addition to the stations actually in operation, plants that are in the course of construction or that are projected for erection in the near future. Thus, at the beginning of 1925, when the installed machinery in French stations with a capacity of 1000 kilowatts or over was developing at average flow .89 million horse power, a number of similar plants were being constructed with an aggregate capacity of .36 million horse power at average flow. At the same time, numerous large stations were in project to develop an additional 5.5 million horse power, at average flow, more than six times as much as was in actual service.[24]

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[23] See above, p. 254.

The object of the projected hydro-electric installations and of the new plants under way was to furnish the much needed large power stations for general purposes and especially for the electrification of railways. Progress in these electrical developments was greatly hampered, however, by a serious deficiency of capital. Even under most normal circumstances the great mass of funds necessary for constructing dams, buying and installing machinery, setting up distribution lines, etc., is difficult enough to obtain because generally there is a fairly long delay before any returns are earned on capital invested in water power. In post-war France the situation was seriously complicated by the shortage of capital and the high rates of interest that prevailed particularly during 1924, 1925 and 1926. The construction of plants already started was retarded for lack of funds, and many approved schemes never got under way at all for the same reason. Thus, despite the fact that the demand for electricity in France was constantly growing and that securities of electric power companies were commanding attractive prices, the various maturely considered plans of development were not being pushed forward as fast as had been hoped.

Since what was chiefly needed was credit, suggestions were made that the French State should furnish its own credit in order to put the water-power resources of the country to good use. The problem was considered of national importance, because the further development of hydro-electric energy was regarded as diminishing France's dependence on Germany and England for coal.[25] But the

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[24] Ministère des Travaux Publics, *op. cit.*, p. 42.

[25] L. Marlio, "Nos Forces hydrauliques" in *L'Outillage économique de la France* by G. Hersent, A. Colson *et alii*, pp. 109–135.

State itself, during the latter years of the post-war period, was in most urgent need of funds, and was in a no better position than private industry to obtain credit. Some aid was, nevertheless, granted by the State after 1921 through the mechanism of agricultural rural credit organizations which lent money on easy terms to communes and coöperative enterprises undertaking to distribute electricity in rural districts.[26]

Once these financial difficulties are more or less ironed out, the future development of the hydro-electric industry in France promises to be very vast indeed. Even when to the 1,750 thousand horse power developed at average flow in 1927 in all stations [27] are added the 285 thousand horse-power plant capacity in construction and the 5,650 thousand horse-power development in form of project at that time, there will still be a good margin between this total of over 7.5 million horse power and the estimated 10 million horse-power potential water-power resources of France at average flow. As it was at the opening of 1927, only about a sixth of the probable water-power capacity of the country was in actual service. The later extensions will undoubtedly proceed from the better and more suitably located sites to those whose exploitation involves a heavier expenditure of capital and which are further away from the points where the power is needed.[28]

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[26] See below, pp. 498-503.

[27] See above, p. 256.

[28] The geographic distribution of the development of water-power sites in France at the beginning of 1925 is shown in the following table:

Section of France	*Horse power developed at average flow in plants of 1000 kilowatt capacity or more*
	(In thousands of horse power)
North, Northeast and Northwest	2,060
Center	84,500
Southwest	235,400
Jura Mountains	34,800
Southeast	530,500

Ministère des Travaux Publics, *op. cit.*, p. 42.

3. Industries Related to the Development of Electric Power

While quantitative data are not always available to give an accurate idea of the electrical power generated in France or in other countries, there are sufficient statistics bearing on the progress achieved by industries dependent on or connected with the development of electric power to shed additional light on the subject. One of the most important of these industries is that engaged in the manufacture of electrical equipment. According to the League of Nations report there was an increase of about 145 per cent from 1913 to 1925 in the value of electrical goods manufactured in France measured for both years on a uniform price basis.[29] In that same interval, as has been seen, the hydro-electric energy generated at average flow had only risen about 52 per cent.[30] The enormous increase in the production of electrical goods in France is accounted for partly by the newer applications of electricity to industry which demand great quantities of apparatus, and partly by the increased development of carbo- and hydro-electric generating plants which require massive units of electro-technical machinery. Another important reason for the rapid development of the manufacture of electrical material is the recent expansion of the French export market for these goods which will be studied in detail in connection with the mechanical engineering industries.[31]

According to German and English estimates, France, both before and after the war, ranked fourth among the nations of the world as a producer of electrical goods.[32] Although only the United States, Germany and Great Britain surpassed France in this respect, the French part in the world's total was still exceedingly small, as is seen in the table on page 263. As an exporter of electrical goods, France held the same relative position, but the value of her exports in 1925 amounted to only about a fourth of that of any of her larger rivals.

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[29] League of Nations, *Electrical Industry*, p. 21.

[30] See above, p. 256.

[31] See below, pp. 327–328.

[32] League of Nations, *Electrical Industry*, pp. 21 and 74.

Country	*Percentage of value of world production of electrical goods in 1925*[33]
United States	48.1
Germany	23.3
Great Britain	11.5
France	4.9
Japan	2.9
Italy	1.9
Austria	1.3
Canada	1.2
Switzerland	1.0
Sweden	0.7
Czechoslovakia	0.6
Russia	0.1
Other Countries	2.5
Total	100.0

As regards the consumption of electrical goods, France falls slightly lower in the scale of international comparison, following Japan as well as the United States, Great Britain and Germany:

Country	*Estimated expenditure on electrical goods in 1925*[34] *(In millions of dollars)*
United States	1,357
Germany	438
Great Britain	280
Japan	101
France	92
Canada	77
Italy	68
Russia	53
Switzerland	26
Austria	23
Sweden	17

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[33] *Idem*, p. 74.

[34] *Idem*, p. 83. Computed by adding imports to production estimates and subtracting exports.

A better measure of France's status as a consumer of electrical goods, and consequently of electrical energy, is to be found in the per capita consumption figures:

Country	*Estimate of the British Electrical and Allied Manufacturers' Association* [35]	*Estimate of the Zentralverband der Deutschen Elektrotechnischen Industrie* [36]
United States	$12.83	$13.72
Canada	8.75	6.07
Germany	7.00	6.72
Switzerland	6.46	4.91
Great Britain	6.52	6.26
Austria	3.81	3.48
Sweden	2.73	2.64
France	2.35	2.31
Italy	1.78	1.02
Japan	1.65	1.64
Russia	.51	.14

Both sets of estimates agree in placing France eighth among the principal countries consuming electrical materials. It is for this reason that, as France becomes more industrialized, and if her per capita consumption of electrical equipment is made to approach that of Great Britain and Germany, the total amount of electrical goods consumed may be expected to increase in large proportions.

Another important industry dependent upon the development of electric power is electrical transportation. Whereas in 1913 it is estimated that only .3 per cent of the total railway system of France was electrified, this proportion increased nearly seven times to 2 per cent in 1926.[37] At the latter date there were about 660 miles of electrified tracks (standard guage only), which constituted a greater length than that existing in any other country of the world except the United States. Nevertheless, neither in the United

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[35] *Idem*, p. 83. The data originally given in pounds sterling were converted into dollars at the rate of $4.86 per pound.

[36] *Idem*, p. 32. The data originally given in Reichsmarks were converted into dollars at the rate of $0.2382 per R. M.

[37] League of Nations, *Electrical Industry*, p. 41.

States (where in 1926 only .8 per cent of the total system was electrified) nor in France, was electric railway transportation as prevalent as in Switzerland with 15.6 per cent of her tracks electrified, or in Sweden with 5.9 per cent electrified, or in Norway with 5.9 per cent electrified, or in Austria, Italy or Holland.

The French are pursuing their programs of railway electrification as rapidly as financial circumstances will allow. They regard it as a matter of public concern because of the coal that may be thus economized. In fact, most of the mileage of the French railway system is far from the main coal resources of the country, so that the railways in the southwest, for example, are obliged to have their coal brought by sea to Bordeaux and other convenient ports. Obviously it is to the advantage of the railways in the vicinity of the great water-power resources to electrify their lines. That is why the most important electrification programs are those of the *Compagnie du Paris-Orléans*, the *Compagnie du Midi* and the *Compagnie du P.L.M.*[38] According to a report issued by the *Union des Syndicats de l'Électricité*, on January 1, 1927, the first of these companies, whose railway runs through the Massif Central, had about 325 miles of electrified lines; the second, whose tracks all lie near the Pyrenees, had about 315 miles electrified; and the third, whose roads run from Paris to the south and southeast of France, had about 23 miles electrified. The state railway had electrified about 49 miles of line, practically all in the suburbs of Paris.[39]

Far more dependent on electric power than railways, which are merely substituting electricity for coal, are the electro-chemical industries. In 1925, these consumed about a quarter of the total electrical energy utilized in France.[40] The principal chemical products manufactured in this way are calcium chloride, calcium cyani-

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[38] Robert Grenet, *L'Électrification des Réseaux de Chemins de Fer français*, p. 138.

[39] League of Nations, *Electrical Industry*, p. 121.

[40] Ministère des Travaux Publics, *Statistique de la Production et de la Distribution de L'Énergie électrique au 1er janvier 1925*, p. 62:

Current furnished by distributing companies —	3,724	million	kilowatt	hours
Current utilized by electro-chemical industry —	1,200	"	"	"
Current lost in conductors and transformers —	2,814	"	"	"
Total consumed in 1925 —	7,738	"	"	"

mide, liquid chlorine, chloride of lime, chlorate of potash, chlorate of soda, and soda itself.[41] Another product which belongs perhaps more properly to the electro-metallurgical industry is aluminum. Since France is almost the only European source of bauxite, which is the ore from which aluminum is obtained by electrolytic processes, it is natural that the French aluminum industry should be highly developed. Each increase in aluminum production noted in the table below has involved a more intense utilization of electric current and of heavy electro-technical machinery:

Year	*Production of aluminum in France*[42] *(in thousands of tons)*
1913	13.5
1923	14.3
1924	16.3
1925	18.0

It is possible that the French aluminum electro-metallurgical industry will expand greatly in the future. In the post-war as well as pre-war period, France was obliged to export more than half of the bauxite extracted. With the further development of the French automobile and aeroplane industries, France may retain more of this ore for elaboration into finished aluminum products.

Electro-metallurgical processes still play a very small part in the production of pig iron and steel. In 1926 only .6 per cent of the total pig-iron output[43] and only 1 per cent of the steel output came from electric furnaces.[44] This nevertheless betokened a moderate advance since 1913, when but .5 per cent of French pig iron and .4 per cent of French steel were produced by means of an electric current.[45] In absolute figures the French output of electric pig iron and steel progressed as follows:

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[41] See below, Chapter XV.

[42] *Annuaire Statistique, 1926*, p. 287.

[43] Comité des Forges de France, *Bulletin* No. 3981.

[44] Comité des Forges de France, *Bulletin* No. 3984.

[45] The 1913 figures were taken from Aimé Coutagne, "L'Électro-Métallurgie," in *Chimie et Industrie*, Vol. I, pp. 303 and 314.

Year	Pig Iron (Including Ferro-Alloys) Produced in the Electric Furnace [46] (In tons)	Steel Produced in the Electric Furnace [46] (In tons)
1913 (not including Alsace-Lorraine)	28,753	21,124
1919 (including Alsace-Lorraine)	55,422	92,338
1920 " " "	59,656	58,080
1921 " " "	55,568	24,457
1922 " " "	69,077	41,434
1923 " " "	78,284	33,351
1924 " " "	71,619	65,639
1925 " " "	40,506	75,443
1926 " " "	59,381	83,554

The continued preponderance of fuel-burning furnaces and converters, and the uncertain expansion of electro-metallurgy in iron and steel production are due principally to the high price of current as compared with coal, especially in the metallurgical regions of the northeast of France. The electric furnace was found to be particularly useful, however, in the manufacture of ferro-alloys and special steels.

Electricity and Fuel Economy

It has been pointed out that one of the principal objects of the intense development of the electrical industry in post-war France, especially as regards the utilization of hydraulic energy, is to economize coal. The extent to which that is feasible is very difficult to determine, since the statistics available are but rough approximations, and the methods of computing the possibilities of substituting water power for coal cannot pretend to be refined or accurate. It appears, however, that if all of the hydraulic energy resources of France were fully exploited, the power thus developed would be insufficient to replace all the power derived from the coal as consumed at present, but would more than equal the power obtained from the coal imported. For example, assuming that the total 9 million horse power of potential hydraulic energy in France were harnessed and the resulting power were utilized 4000 hours a year, the yield would be 36 billion horse-power hours. These 36 billion horse-power hours may be computed as representing a consumption of coal amounting to between 40 and 45 million tons, if each ton of coal be taken to yield around 800 horse-power hours.[47] It is interesting to observe that 40 million tons are equivalent to a little more than half of the coal actually consumed in France in 1926, exceeding the net imports of that year by about 50 per cent.[48]

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[46] The figures up to 1923 were taken from the *Statistique de l'Industrie minérale*, and those from 1924 on from the *Bulletins* of the Comité des Forges.

If the problem be approached, not from the point of view of theoretical possibilities in the eventual future, but in the light of present conditions and needs, it is seen that the economy realized in fuel consumption through electrical development has thus far been rather limited. The 4.56 billion horse-power hours which were generated in French hydro-electric stations in 1923 [49] may be estimated as representing the energy of about 5 million tons of coal. This does not mean that France economized that much fuel which she otherwise might have been obliged to import. In the first place an indeterminate part (from a third to a half) of the hydro-electrical energy generated was lost in conductors and transformers; and in the second place hydro-electric power was not always used in the place of coal and steam power, but was often simply juxtaposed to create new forms of energy, like light and sound, for which coal had never been directly used. It is only on the basis of the far-fetched supposition that the 4.56 billion horse-power hours would have been generated in carbo-electric stations had there been no water-power plants in France, that about 5 million tons of coal may be regarded as having been saved.

Another reason why, in the present state of technological progress, electricity cannot go very far to replace coal, is the relative cost of hydro-power as compared with carbo-power. The cost increases enormously the greater the distance from the generating station, because of the amount of energy lost in long transmission lines. In fact, it has rarely been found worth while to transport current over more than a few hundred miles of wire. Since the industrial centers of France lie to the north and the northeast, far from water-power resources and near the coal deposits, hydro-electricity could make little or no headway there. Coal even competes at times with hydro-electricity on the latter's own domain — in the southwest, for example, where English and Welsh coal can be brought very cheaply by sea routes. It is to be expected that the development of hydro-electricity may vary with fluctuations in the price of coal and with improvements in the technique of transporting and distributing current which may bring down the cost of electric power.

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[47] The rate is about 800 horse-power hours per ton of coal used to generate motive force in industry, but it is a little higher for other industrial purposes and for heating.

[48] See *Annuaire Statistique, 1926*, p. 127.

[49] Ministère des Travaux Publics, *Statistique de la Production et de la Distribution de l'Énergie électrique du 1er janvier 1925*, p. 62.

Indeed, it does not seem probable that the more widespread use of electricity will effect any very appreciable economy in coal consumption in the calculable future. Although, at present, only about a sixth of the potential hydraulic energy (at average flow) is harnessed in France, the exploitation of the remaining five-sixths is likely to be pursued more and more slowly, because the water-power sites that are allowed to remain undeveloped are generally uneconomical to utilize or inconveniently situated. In the meantime, the French market for electricity manifests a capacity for almost indefinite extension. For example, only 17,000 of the 37,800 communes of France were electrified in 1927.[50] The electrification of the remaining 20,000 communes may even involve a greater consumption of coal because many of these communes are out of the range of hydraulic power resources, and because in agriculture electric energy replaces animal and muscular energy, and not coal. It must be remembered, however, that while electricity may not solve the coal problem, its continued development may be expected to aid in the industrial expansion of the country and to raise the standard of material comfort.

[50] Maurice Bitouzet, "L'Électricité en Agriculture," in Michel Augé-Laribé *et al.*, *L'Agriculture*, p. 102.

CHAPTER XI

IRON AND STEEL I: METALLURGY

THE power derived from coal, or oil, or waterfalls would be of little industrial use, were it not for the machines which direct the crude motive force into productive channels. Modern machinery, so delicately and so finely precise and withal of such tremendous strength, would be impossible — at least on a large and universally widespread scale — without iron and steel. Other materials, stone, wood, rubber, leather, copper, etc., also enter commonly into the making of machinery, but iron and steel are much more fundamental than any other substance both in the formation of the structural skeleton and of the detailed mechanism of present-day instruments of production. That is why France's post-war supply of iron ore, one of the basic raw materials of iron and steel, is of incomparable significance to the industrial welfare of the country.

1. IRON ORE RESOURCES IN FRANCE

Even before the war the iron ore deposits of France were very considerable. It was estimated by the International Geological Congress of 1910 that the French resources amounted to 3.3 billion tons, which represented about a third of the iron ore then known to exist in Western Europe.[1] The French supply was, according to this estimate, greater than that of any other European country except Germany, where it was only slightly larger: 3.6 billion tons. Great Britain was said to possess 1.3 billion tons; Sweden, 1.2 billion tons; Russia, .8 billion; Spain, .7 billion; Luxemburg and Austria Hungary each about a quarter of a billion; and Italy only .06 billion tons. These figures accounted only for the workable deposits known to exist at that time, and were in some cases underestimates, as later discoveries showed.

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[1] Ministère du Commerce, *Rapport général sur l'Industrie française*, Vol. I, p. 61.

Since the war France has acquired additional iron ore resources, thanks to the reannexation of that part of Lorraine which had been wrested from her in 1871, and which now constitutes the département of Moselle. The deposits there are said to contain about 1.8 billion tons of ore.[2] Altogether the more recent estimates place the iron ore resources of post-war France at a figure varying between 6.5 and 7 billion tons, that is to say, at more than half of all Europe's supply.[3] There is, no doubt, a large margin of error in all these estimates, especially as concerns the less known areas of Europe. Moreover there is little agreement among geologists and engineers regarding the quality and iron content of the ores in different countries. Nevertheless one thing is unquestionably true, namely, that post-war France holds by far the most important iron ore deposits of Europe, while those of Germany are small, scattered and of inferior quality.

The Lorraine beds of iron ore, lying in the northeast corner of France, in the départements of Meurthe-et-Moselle (the part of Lorraine which had remained French after 1871) and of Moselle, are the most important not only of France but of all Europe. They form part of a vast iron bearing zone which extends into Luxemburg and Belgium, and of which the total deposits are computed at about 5.1 billion tons. The French portion, containing about 4.8 billions, constitutes nearly 95 per cent of the whole.[4] In Moselle a large part of the ore beds lie on the surface or at shallow depths, thus making surface mining possible; but westward, in Meurthe-et-Moselle, the deposits lie much deeper and shafts have to be sunk. The ore in the latter mines has the advantage of a higher iron content, being between 35 and 40 per cent, while in Moselle it is about 30 per cent.

The value of the Lorraine iron ore basin is greatly enhanced by its propinquity to the coal fields of the Saar, of the north of France and of Westphalia. The ore of this region, however, has the defect of containing a great deal of phosphorus pentoxide, which renders steel made from it under ordinary conditions too brittle to be of any use. It was, in fact, the relative absence of phosphorus from British ore which explained largely the superior position of England in the economic history of Europe during the first half of the nineteenth century. Not until about 1875, that is, several years after the Franco-Prussian War, was a method of dephosphorizing Lorraine ore discovered. The inventor was a young Englishman, Sidney Gilchrist Thomas, who, in reality, made possible the practical application of a chemico-metallurgical principle previously enunciated by a French professor, Gruner. With the adoption of the Thomas process, the great iron and steel industry of Continental Europe began. Thus also was inaugurated the industrial greatness of Germany which rested on a cornerstone of steel production.

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[2] *Idem*, Vol. II, p. 965.

[3] J. Levainville, *L'Industrie du Fer en France*, p. 3; Henry Laufenburger, *L'Industrie sidérurgique de la Lorraine désannexée et la France*, p. 24; Chester Lloyd Jones, *French Steel and Iron Industry*, U. S. Department of Commerce, Trade Information Bulletin No. 367, pp. 1–2.

[4] Alfred H. Brooks and Morris F. LaCroix, *The Iron and Associated Industries of Lorraine, the Saar District, Luxembourg and Belgium*, U. S. Geological Survey, Bulletin No. 703, p. 18.

Important iron ore deposits are also found in the west of France: in Brittany and in Anjou, where there are about a billion tons; in Normandy and in Maine, where there are .8 billion tons.[5] In these regions the deposits are not as rich or as continuous as in Lorraine. Moreover, the ore contains a high percentage of impurities, particularly silica, but the phosphorus content is medium. Nevertheless these mines, because of their distance from the front, were intensely exploited during hostilities, and after the war the western ores proved adaptable to most iron and steel metallurgical processes. As a result, French manufacturers who had previously allowed most of this supposedly inferior ore to be exported began to compete with foreign buyers for its acquisition. Germany and England had long been purchasers of French iron ores of the west basin, because they were found near the sea, and could be conveniently supplied to vessels unloading coal.

The iron mines of the Pyrenees are less valuable than those described above, for the reserves are estimated at only about 100 million tons.[6] These ores do not, as a rule, lie in beds, but in irregular formations. They are extremely rich, however, containing from

[5] Levainville, *op. cit.*, pp. 6–10.

[6] Levainville, *op. cit.*, p. 10.

50 to 55 per cent of iron, and they are free from phosphorus and sulphur. The Pyrenees ores are much in demand for making special grades of pig iron and steel, and they go to supply the steel industries of south central France.

There are, besides, a number of secondary deposits scattered in central and eastern France, which in the past had a certain importance. In more recent times a number of these mines were completely abandoned, since they could not survive in competition with the Lorraine iron industry. The relative practical importance of the various iron ore basins is seen in the proportions extracted. In 1926, of the total iron ore production of France, 94 per cent came from Lorraine, 4.9 per cent from the west, about 0.7 per cent from the Pyrenees, and a very small fraction of one per cent from the rest of France.[7]

The Manufacture of Pig Iron

The current metallurgical processes by which the crude iron ore is converted into iron and steel require carbon as well as iron ore as an essential raw material. The ore, which is really an oxide of carbon, must be reduced, i.e., deoxidized, by burning it at a high temperature with carbon, which is the deoxidizing agent. Originally charcoal made of wood was used to furnish the necessary carbon. While charcoal iron was very pure, containing only .05 per cent of carbon, the process was slow and difficult, and charcoal was not easy to obtain in sufficient quantities without carrying deforestation to the danger point. Very early in the history of modern industry coal was on rare occasions substituted for charcoal, but it was not until 1782 that the first French blast furnace at Creusot utilized coke, the carbon residue of distilled coal, and thus a virtual technical revolution was begun.

It was found that if much larger amounts of carbon were burnt with the iron ore, the oxygen was more easily eliminated but the iron absorbed from 60 to 80 times as much carbon. The new product was pig iron, which contained from 2.5 to 4 per cent of carbon, and was more brittle, less tenacious and less malleable than the purer charcoal iron. It nevertheless proved to be a useful metal, for it could easily be cast into various objects such as stoves, pipes, etc.

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[7] André Fraigneau, "Les Industries extractives," in the *Revue d'Économie Politique,* March–April, 1927, p. 592.

When subjected to the process of refining, that is, of reducing the carbon content, pig iron yielded a new metal, steel. The maximum proportion of carbon in steel is 1.5 per cent. When it contains between .5 and 1.5 per cent it is very hard and easily tempered. Pure iron and soft steels are obtained when still more carbon is eliminated, leaving less than .5 per cent. One of the great advantages of all steel is that it can be forged and welded with other pieces of steel at a fairly low point of fusion. The superiority of steel over wrought iron and the comparative ease with which it is produced meant that as time went on more steel and less iron was manufactured.

Pig iron is thus an intermediate product in the elaboration of iron and steel. It is made under modern conditions in furnaces that are very tall, from 40 to 100 feet high, shaped somewhat like a vase. These blast furnaces (*hauts-fourneaux*) vary in capacity, but at the present time most of them produce from 200 to 300 tons a day. Coke and iron ore are poured into the blast furnace from the top so as to form alternate layers. The proportions of each vary according to the quality of the coke and the amount of impurities contained in the ore. Usually the weight of the ore is double that of the coke, and it requires roughly a ton of coke and two tons of ore to produce a ton of pig iron.

The manufacture of pig iron is complicated by the fact that not all coal will on distillation produce a coke suitable for blast furnaces. Metallurgical coke must possess the quality of firmness lest it be ground to useless powder under the weight of heavy layers of ore and then of more coke and again of ore that are heaped on it in the blast furnace. Beside these mechanical properties, it must be chemically so constituted as to give sufficient heat on combustion and at the same time to absorb the oxygen in the ferrous oxide ores. The coal yielding the best metallurgical coke is that containing from a fifth to two-fifths of volatile oils.

Experimentation is being carried on continually to discover a method of using other kinds of coal, for past practice has shown that the only coal thus far utilizable for producing metallurgical coke is neither evenly nor widely distributed. In Western Continental Europe the most important source of coking coal is the Ruhr basin, which straddles the Rhineland and the province of Westphalia. The Saar coal is not so efficient, and its coke is generally used in blast furnaces mixed with at least 20 per cent of Westphalian coke or other coke of equally good quality.

The Manufacture of Steel

Once pig iron has been produced by smelting the iron ore, it may be used in one of three ways. It may be remelted in a cupola and cast in molds for the manufacture of cast-iron objects which are many and extremely varied. Or the pig iron may be converted into wrought iron by the puddling process. The puddled iron is generally hammered, reheated and rolled into what is known as merchant iron. Finally the pig iron may be made into steel, and this process, in view of the continually expanding use of steel, absorbs by far the greatest quantity of pig iron produced.

There are a number of ways of reducing the carbon content of pig iron for the production of steel. What is known as the Thomas process, which is in reality a basic variant of the Bessemer process, is used very largely in France because of the phosphorus in the Lorraine pig iron. Much French steel is also produced in the open hearth furnace, where oxidized steel and iron scrap are added to the pig iron to absorb part of the carbon. In 1924 about 1 per cent of French steel was produced in the electric furnace and .2 per cent in crucibles,[8] but these processes yield special steels, usually alloyed with other metals.

The molten steel, as it comes from the Bessemer converter, the open-hearth furnace, the crucible, or the electric furnace, is usually first cast into ingots, though some of it is cast directly in molds. The ingots, either in their incandescent state or on reheating, are put through great rolling mills which press the steel into different shapes — blooms, billets, plates, bars, rails, profiles and various structural forms. The ingots are thus transformed for the most part into semi-finished products, while some are made at once into finished products such as steel wire, tubes and the like. The semi-manufactured output of the rolling mills then finds its way into the mechanical engineering industries where it is turned into more or less finished products, railway material, automobiles, machinery, industrial and agricultural tools, mining equipment, ships, instruments and a host of miscellaneous objects.

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[8] C. L. Jones, *op. cit.*, p. 25.

The Rôle of Coal

At every step in the elaboration of pig iron, whether it is cast upon reheating, whether it is puddled, or whether it is converted into steel, a great deal of heat and power are required. Even at the terminal stage, when the semi-manufactured iron and steel are transformed into finished products, power is consumed in great quantities. As it has been observed in previous chapters, the only adequate source of heat and power, where these are required on a large scale, is, in present practice, coal. Thus coal lies at the basis not only of the primary chemico-metallurgical processes, but also of the whole mechanical engineering industry.

Modern industrialization which is, to be sure, built on iron and steel, would be impossible or badly hobbled without sufficient coal. The United States, Great Britain and Germany before the war attained the status of first rate industrial powers thanks to their rich supplies of both coal and iron. France ranked below these countries, in spite of her enormous pre-war iron resources, simply because of her limited coal supply. Belgium's industrial prosperity was built on the coexistence of coal and iron within her territory. Spain and Sweden both had iron, but practically no coal. Italy had neither. These latter nations were indeed little industrialized. It is true that countries like Russia and China, which nature endowed with unfathomable coal and iron resources, were nevertheless very backward industrially, but this was due to the lack of development of the industrial arts, which, in turn, may have been partly caused by their distance from the centers of diffusion of modern material culture. These countries have, however, an industrial future.

Although, from the purely economic standpoint, it is desirable that the iron ore resources and the coal mines be near each other, the development of industry within a given region is not necessarily secured by such proximity. The trade barriers which are built on national boundaries may, and, in fact, do, as in the Ruhr-Lorraine region for example, separate coal from iron quite as much as a far greater distance would do.[9] The development of industry in Europe would probably have been very different had the tariff weapon been dispensed with. Nevertheless, it should be noted that over the vast area of the United States, which is unbroken by national frontiers, the distribution of industry is markedly unequal.

It was the Treaty of Versailles which drew the boundary line between the iron of reannexed Lorraine and the coal of the Ruhr, whereas formerly they had been united within the German frontiers. Thus the Ruhr-Lorraine region, which before the war had constituted an industrial center equal in many respects to the north of England, was broken up, most of the coal remaining on the German side and most of the iron ore on the French side.

Hence the question may be raised whether industrial development tends to take place near the iron mines or near the coal mines, or whether it tends to be more or less equally divided, when coal and iron resources are for any reason separated. Observation in different parts of the world reveals that the metallurgical industry is generally situated in the neighborhood of coal, rather than of iron. In pre-war Germany the metallurgical industries were more highly developed near the Westphalian coal beds than near the iron basin of what was then German Lorraine. In pre-war France the metallurgical plants were larger and more numerous in the coal-bearing northern départements than in Meurthe-et-Moselle where iron was mined. In the United States the greatest metallurgical development was far more evident near the coal mines of the east than near the great iron mines of Minnesota and Michigan. In England, too, blast furnaces and rolling mills were more frequent in the vicinity of coal shafts than of iron deposits. The conclusion one might be tempted to draw from such uniform data would nevertheless be questionable, because there are so many other factors that enter into determining the location of metallurgical plants. For example, the American pig iron manufacturers' preference of the east was due very largely to the fact that railways, ports, large cities, commercial facilities and industrial traditions were much more intensely developed in the east than near the most important iron deposits. The pre-war German metallurgists' preference of the Ruhr valley to Lorraine is said to have been the result of the military policy of the Government which dictated the concentration of blast furnaces as far away as possible from the frontier of that time.

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[9] See above, Chapter II, pp. 29–36.

A priori it would seem that the production of pig iron ought to take place nearer the iron mines than the coal beds, since about twice as much ore as coke is required for the manufacture of a ton of pig iron. That would be perfectly true if the metallurgical process stopped at the first stage, but modern plants are frequently integrated in such a way that most of the pig iron is converted into semi-finished cast iron, wrought iron and steel products within the same factory grounds where the blast furnaces are situated. A certain economy is realized in the utilization of the hot gases of the blast furnace to give heat and power to the rolling mills, for example, but generally these gases are counted upon only as adjuncts to the main source of heat and power, which is coal. Thus while only about half as much coke as ore may be needed in the first stage, so much coal is required in the successive converting, rolling, forging, turning and other processes that coal and iron ore may be regarded as factors of at least equal importance in metallurgy. Sometimes, indeed, a greater weight of coal than of ore is required to carry steel products through from the earliest raw stages to the finished state. Industry is most favored where coal and iron are found close together, as in northeastern France and the north of England.

2. Production and Consumption of Iron Ore and Pig Iron

Production and Consumption of Iron Ore in France

Even before the war, when a considerable part of the Lorraine resources were on the German side of the frontier, the French iron ore output exceeded that of any other country in the world except the United States and Germany. The average annual production during the 1911–1913 period was 19 million tons in France, 26.5 million in Germany and 53.5 million in the United States. Great Britain was far behind France with 15 million tons; Spain produced 9.2 million tons; Russia, 8.1 million; Sweden, 6.7 million; and Luxemburg, 6.5 million. Italy produced a bare half a million, and Belgium's output was almost negligible.[10] Measured in per capita terms France's production was .5 tons, surpassed only by that of the United States with .55 tons, while Germany and Great Britain produced .4 and .37 tons per capita respectively.

The effect of the outbreak of hostilities was to interrupt the extraction of iron ore in France almost completely, for French Lorraine (Meurthe-et-Moselle) was seized by the enemy at the very beginning of the war and was held by them up to the Armistice. This gave Germany an important strategic advantage, while France was cut off from a region that in 1913 had yielded 83 per cent of the total iron ore produced within the country. Moreover, the French were almost entirely deprived of another 9 per cent of their pre-war production because a number of the mines were situated within the zone of military operations. As a result, during the war the iron ore extracted in France never attained even 10 per cent of the amount produced in 1913.[11]

The Treaty of Versailles brought to France, as has already been noted, a vastly increased capacity of iron ore production. This was, to be sure, not evident in the extraction figures of the first three years after the war. Once the period of reconstruction was over, however, the importance of the newly acquired basis of further industrial development was soon manifest. In the reannexed section of Lorraine the average annual output of iron ore before the war was even greater (19.6 million tons annual average for 1911–1913) than in the whole of France (19.3 million tons). The course of production in post-war France as compared with pre-war France is shown in the following table:

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[10] League of Nations, *Memorandum on the Iron and Steel Industry*, p. 38.

[11] Ministère du Commerce, *op. cit.*, Vol. I, p. 67.

Year	*Production of iron ore in France*[12] *(in millions of tons)*
1911–1913 (including Alsace-Lorraine)	38.9
1911–1913 (not including Alsace-Lorraine)	19.2
1919 (including Alsace-Lorraine)	9.4
1920 " " "	13.9
1921 " " "	14.2
1922 " " "	21.1
1923 " " "	23.3
1924 " " "	29.0
1925 " " "	35.7
1926 " " "	39.5
1927 " " "	45.7

Thus France produced in 1927 almost two and a half times her annual output during 1911–1913, and about 18 per cent more than France plus Alsace-Lorraine at that time. In 1925, when French production was about 14 per cent higher than the annual average output of France and Alsace-Lorraine from 1909 to 1913, German production (computed both before and after the war within post-war territorial boundaries) was about 8 per cent lower, British production 35 per cent lower, and Spanish production about 52 per cent lower. The iron ore extracted in the United States increased about 15 per cent in the same interval, and that of Sweden rose over 37 per cent, chiefly because of her increased exports to Germany.[13]

The consumption of iron ore in France had increased in 1924 as compared with 1913 to an even greater extent than production. Figures for 1925, 1926 and 1927, comparable with those of the previous years, are not available because of the inclusion of the Saar in all foreign trade statistics from 1925 on. Nevertheless, for these latter years the movement of the production of pig iron, which is necessarily very much the same as that of the consumption of ore, shows again that the consumption of iron ore tended to outstrip production in its rate of post-war expansion. This was probably due to the fact that Germany was not importing as much from France as she had taken before the war from the Lorraine region.

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[12] Sources: *Annuaire Statistique, 1926*, p. 57, for figures up to 1924; *Bulletin de la Statistique Générale de la France*, for 1925–1927. The 1911–1913 figure of production in France and Alsace-Lorraine combined was taken from League of Nations, *op. cit.*, p. 38.

[13] League of Nations, *op. cit.*, pp. 38–39.

Production and Consumption of Pig Iron in France

Pre-war France ranked fourth among the countries of the world producing pig iron. During 1911–1913 the average annual French output was 4.9 million tons, while British production was 9.7 million tons; German production, 15.3 million tons; and that of the United States, 28.6 million tons. Belgium produced only 2.3 million tons. France was, however, fifth in per capita production with .12 tons, coming after Belgium with .30 tons per capita, the United States with .29 tons, Germany with .23 tons, and England with .23 tons.

During hostilities the output of pig iron in France fell to about a quarter of its pre-war level, the main reasons being the occupation by the enemy of the iron-bearing basin of Lorraine and the acute shortage of coal and coke. When peace was restored, however, France found her capacity for the production of pig iron greater than it had ever been before, because of the reincorporation of what had been German Lorraine with its iron mines and blast furnaces. Unfortunately for France, very little in the way of resources of coking coal were added.

In 1913 France had 129 blast furnaces in operation,[14] while in German Lorraine there were at the same time 51 blast furnaces producing iron.[15] The total number of blast furnaces on the eve of the war, including the idle ones, was 164 in France and 64 in what was then German Lorraine.[16] The number of French blast furnaces was therefore increased under the terms of the Treaty of Versailles by about 40 or 50 per cent. This alone is, however, a poor indication of the actual increase in France's productive capacity after the war, because blast furnaces vary considerably in size. The average annual output in German Lorraine from 1911 to 1913 was 3.3 million tons which was more than two-thirds that produced by France (4.9 million tons), in the course of the same period.[17]

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[14] Comité des Forges, *Bulletin* No. 3431, p. 64.

[15] Alfred H. Brooks and Morris F. LaCroix, *op. cit.*, p. 54.

[16] Jones, *op. cit.*, p. 18; and League of Nations, *Memorandum on Iron and Steel*, p. 87.

The figures below tell the story of the movement in the production of pig iron since the war:

Year	*Production of pig iron in France* [18] *(In millions of tons)*
1911–1913 (including Alsace-Lorraine)	8.0
1911–1913 (not including Alsace-Lorraine	4.9
1919 (including Alsace-Lorraine)	2.4
1920 " " "	3.3
1921 " " "	3.4
1922 " " "	5.3
1923 " " "	5.5
1924 " " "	7.7
1925 " " "	8.5
1926 " " "	9.4
1927 " " "	9.3

It will be observed that in 1921, the year of industrial depression, the increase over the preceding year was extremely slight; and in 1923 the rate of expansion was checked again owing to the occupation of the Ruhr. It was only after 1926 that the pig iron production of greater France reached and surpassed that of France and Alsace-Lorraine combined before the war. Whereas the French pig iron production was in 1926 nearly 5 per cent greater than that of France together with German Lorraine in 1913, Germany's production within the same post-war frontiers fell about 13 per cent from 1913 to 1926, and British production fell about 39 per cent from 1913 to 1925 (1926 being the year of the coal strike, the low pig iron production in England in that year was untypical). In the United States the pig iron production had increased by about 27 per cent from 1913 to 1926.[19] In fact, France's 1926 output of pig iron was second only to that of Germany among European nations.

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[17] League of Nations, *op. cit.*, pp. 40–41.

[18] Sources: *Annuaire Statistique, 1926*, for figures up to 1924; *Bulletin de la Statistique Générale de la France*, for 1925–1927. The 1911–1913 figure of production in France and Alsace-Lorraine combined was taken from League of Nations, *op. cit.*, p. 40.

The record of consumption of pig iron in France was not very different from that of production. Before the war practically all (99 per cent) of the pig iron produced in France was consumed within the country. German Lorraine, on the other hand, shipped about two-thirds of its output into the interior of Germany, so that France and Alsace-Lorraine combined may be said to have consumed in 1913 about 85 per cent of their joint production. Throughout the post-war period, except in 1921, the portion of the production of greater France that was destined for domestic consumption was somewhat larger, being 87 per cent in 1922 and 91 per cent in 1924.[20] This increased home consumption may be said, in a certain measure, to have been forced on France because of Germany's post-war effort to render herself as independent as possible of Lorraine pig iron, even though she had lost by the Treaty of Versailles 159 of the 376 blast furnaces she possessed before the war.[21] The capacity of production of the German blast furnaces in 1926 was considerably greater than it had been within the corresponding territory in 1913. The result was, however, not disadvantageous to France, for it was more profitable for her to make iron castings and steel for export and domestic use on her own territory than to send the raw pig iron abroad to be transformed elsewhere.

Increased Coke Requirements

The expanding French pig iron industry involved an ever increasing consumption of coke. Since, as has been seen, very little suitable metallurgical coke is derived from French coal, every advance in French pig iron production meant that France was becoming more and more dependent on foreign coke or coking coal, that is to say, on Germany, the country from which most of the coke came.

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[19] League of Nations, *op. cit.*, pp. 40–41.

[20] Comparable figures after 1924 are unavailable because the Saar trade figures were included with those of France from 1925 on.

[21] League of Nations, *op. cit.*, p. 87.

In 1913 the French production of coke was 4 million tons and her net imports 2.9 million tons [22] which would lead one to believe that France produced about 58 per cent of her consumption. It must be borne in mind, however, that France manufactured part of her metallurgical coke from imported coal, so that her production of coke from French coal represented perhaps only about 50 per cent of the total amount of coke consumed. In the years following the war France utilized more imported coal than ever before for metallurgical coking. This was due partly to her increased demand for coke, partly to the difficulty experienced in obtaining coke from Germany, and partly to the fact that several years elapsed before the damaged metallurgical-coke yielding mines of the north of France were reconstructed. In fact, from one-third to one-half of the coal used for making coke in France in the post-war years was imported. The following table shows the estimated percentage of metallurgical coke consumed which was derived from French coal:

Year	*Estimated ratio of metallurgical coke consumed in France derived from French coal* [23]
1913 (not including Alsace-Lorraine)	51%
1919 (including Alsace-Lorraine)	39
1920 " " "	15
1921 " " "	25
1922 " " "	18
1923 " " "	31
1924 " " "	33
1925 " " "	39

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[22] Ministère du Commerce, *op. cit.*, pp. 68–70.

[23] These percentages are necessarily estimates because no separate statistics of the amount of metallurgical coke made from French coal and the amount made from imported coal are available. All that is known are the quantities of imported coal distilled into metallurgical coke and the aggregate amount of coke produced. If it be assumed that all the coal, whatever its origin, yielded the same proportion of coke per ton, then estimates of coke derived from domestic coal and that derived from imported coal may be computed. For data, see *Statistique de l'Industrie Minérale* and *Stat. Mens. Com. Ext.*

Although there was a considerable increase in the domestic production of metallurgical coke in the latter post-war years, the dependence of France on imported coke was by no means reduced; on the contrary it was vastly increased:

Year	Total Metallurgical Coke Produced in France (In thousands of tons)	Net Imports of Coke (In thousands of tons)
1913 (not including Alsace-Lorraine)	4,027	2,865
1919 (including Alsace-Lorraine)	1,667	1,770
1920 " " "	1,761	4,566
1921 " " "	1,861	2,644
1922 " " "	2,362	4,690
1923 " " "	4,287	3,133
1924 " " "	5,415	4,875
1925 " " "	.....	4,530
1926 " " "	.....	5,083

This enlarged volume of net imports was undoubtedly due to the reannexation of Alsace-Lorraine, because of the additional iron mines and blast furnaces in the latter province. As has already been seen, France before the war manufactured between 50 and 60 per cent of its metallurgical coke requirements, but German Lorraine at that time had to procure practically all the coke it consumed (4.9 million tons) from the outside (4.8 million tons).[24] France and Lorraine together in 1913 imported not between 40 and 50 per cent as did France alone, but more than 65 per cent of their joint requirements. The gap between French metallurgical coke consumption and production was thus widened as a result of the Treaty of Versailles, so that in 1924 only about a third of the coke consumed was derived from French coal.

From the economic point of view the seriousness of the French deficit in metallurgical coke resources is not as great as it might be thought, since coke, though bulky, is less heavy than coal and consequently more easily transported. The Ruhr is a near-by source, and so long as German prices and export duties are not raised to prohibitive levels, French metallurgy can obtain all the coke it needs. It is only when the problem is looked at from a nationalist and political standpoint that French dependence on German coke seems disadvantageous. Coke and coking coal could, indeed, be imported from England, but the cost of transport to Lorraine would be much heavier, and France would be no nearer independence. Even if the Territory of the Saar should become definitely incorporated with France, the problem would hardly be nearer solution, since Saar coke can only be employed in current practice with other types of coke, and this would still involve importation. Saar coke might indeed be used alone, but in small blast furnaces the construction of which would necessitate very considerable expenditure. The best way of resolving the difficulty would seem to consist in friendly commercial and political relations with Germany.

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[24] Ministère du Commerce, Vol. II, p. 967.

3. PRODUCTION AND CONSUMPTION OF STEEL IN FRANCE

The shift from the utilization of iron to that of steel in modern France was such that by 1913 more than four-fifths of the pig iron produced was converted into steel, leaving less than a fifth to be used directly as iron castings.[25] In fact, paradoxical as it may seem, more steel was produced in France in 1913 than pig iron was consumed for the purpose, since 4.7 million tons of steel were turned out and only 4.3 million tons of pig iron apparently found their way to the steel mills. This is easily explained by the fact that in the open-hearth process scrap iron and steel are added to pig iron. It is seen, therefore, that scrap is an important raw material in the making of steel — so much so, that some countries which have no developed pig iron industry, like Italy, for example, depend very largely on the importation of scrap iron and steel for their metallurgical industries.

The following figures give the production of steel in France since the war:

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[25] For these and the following statistics, see Appendix C, p. 590.

Year	*Production of steel in France (In millions of tons)*
1913 (including Alsace-Lorraine)	7.0[a]
1913 (not including Alsace-Lorraine)	4.7
1919 (including Alsace-Lorraine)	2.2
1920 " " "	2.7
1921 " " "	3.1
1922 " " "	4.5
1923 " " "	5.1
1924 " " "	6.9
1925 " " "	7.4
1926 " " "	8.4
1927 " " "	8.3[b]

[a] League of Nations, *op. cit.*, p. 42, for production in France and Alsace-Lorraine combined in 1913.

[b] *Bulletin de la Statistique Générale de la France.*

While France was producing 20 per cent more steel in 1926 than in 1913 within the same enlarged frontiers, Germany within comparable post-war frontiers was producing only .9 per cent more, Great Britain was producing 3.5 per cent less (in 1925, for comparisons with 1926 would be unfair on account of the coal strike), and only the United States among the larger nations exceeded France's progress with a 55 per cent increase.[26] Thus at the close of the post-war period under survey the steel industries of France were in a more favorable position than they had ever been before when compared with those of other European countries, as the table on the following page indicates.

It will be observed that the French post-war steel output showed less unsteady variations than that of iron ore or of pig iron. It was, for example, less affected by the business depression of 1921 or by the occupation of the Ruhr. Furthermore, while the average annual iron ore output of greater France in the years 1925–1927 was 6 per cent less than that of 1913 within the same territory, and of pig iron only 2 per cent larger, steel production increased by as much as 14 per cent. This is explained by the fact that what

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[26] League of Nations, *op. cit.*, pp. 42–43.

COUNTRY	PERCENTAGE OF WORLD STEEL PRODUCTION[27]	
	1909–1913 average (pre-war territory)	1926 (post-war territory)
United States.......	42.5	52.4
Germany..........	22.3	13.1
France.............	6.0	8.9
England...........	10.2	8.3[a]

[a] 1925.

had been formerly German Lorraine ceased during the post-war years to be a region of which the principal function was to supply iron ore and pig iron to the elaborative industries of Germany. As far as possible the French encouraged the development of steel manufacturing and other higher metallurgical industries on their own territory.

Practically all the crude steel, in the form of ingots produced in France both before and after the war, was consumed, that is, put through the next processes of elaboration, within the country. There was, in fact, very little foreign trade in ingots, exports from 1911 to 1913 amounting to .13 per cent of production and from 1925 to 1927 to .49 per cent.[28] This relative absence of commerce in ingots is inherent in the very nature of current steel manufacturing practice, since the ingots are run, before they have had time to cool, through the rolling mills and are thus converted at once into semi-manufactured products. In this process about a third of the ingot which is found at the thicker end and which has more impurities than the rest is cut off. It is obvious that transportation charges must be considerably less for semi-finished and finished steel products than for ingots.

Production of Semi-finished and Finished Steel

Steel ingots, when they have been rolled and forged into blooms or billets, that is to say, elongated and reduced in breadth and depth, or when they have been further modified in shape so as to produce bars, are converted into semi-finished products. These blooms, billets and bars are sometimes sold to steel mills specializing in continued steel elaboration, or they may be pressed on the spot into such products as rails, plates, profiles, wires and the like which are known as finished steel. The conversion of finished steel into manufactured objects, like tools, machines, locomotives, etc., belongs to the mechanical engineering industry and will be discussed in the following chapter.

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[27] League of Nations, *op. cit.*, p. 44.

[28] See *Stat. Mens. Com. Ext.*

The production of semi-finished and finished steel shows a recovery and development quite similar to the movement in the production of crude steel:

YEAR	PRODUCTION (In millions of tons)	
	Semi-finished Steel[29]	Finished Steel[30]
1913 (including Alsace-Lorraine)	3.2[a]	4.3[b]
1913 (not including Alsace-Lorraine)	2.4	3.1
1920 (including Alsace-Lorraine)	2.0	2.0
1921 " " "	2.0	2.2
1922 " " "	2.8	3.1
1923 " " "	3.3	3.6
1924 " " "	4.5	4.7
1925 " " "	2.5	4.9
1926 " " "	3.1	5.5

[a] Estimated by adding to the production of pre-war France that of reannexed Lorraine (797,150 tons) as reported in the *Industrie sidérurgique en 1923–1924–1925, Compte-rendu* published by the Association des Maîtres de Forges de Lorraine, p. 29.

[b] Estimated by adding to the production of pre-war France that of Alsace-Lorraine as reported by Robert Pinot, "La Sidérurgie," in *Chimie et Industrie*, Vol. I, p. 1209. M. Pinot's figure (1,253,790 tons) is somewhat lower than that given in *L'Industrie sidérurgique en Lorraine 1923–1924–1925*, *loc. cit.* (1,363,800 tons), but is probably more comparable with French production in 1913 because it includes more nearly the same products.

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[29] The figure for 1913, not including Alsace-Lorraine, was taken from the *Annuaire général de la France et de l'Étranger*, those for 1920 to 1923 from the *Statistique de l'Industrie minérale*, and the remaining figures from the *Bulletins* of the Comité des Forges.

[30] League of Nations, *Memorandum on the Iron and Steel Industry*, p. 50; the 1926 figure was taken from *Bulletin* No. 3984 of the Comité des Forges, p. 7.

4. THE DEVELOPMENT OF THE INDUSTRY AS A WHOLE

The post-war growth of the metallurgical industry, taken as a whole, may be summarized as follows. The industries engaged in the more advanced stages of manufacture, such as the production of steel ingots, semi-finished and finished steel, made greater progress in output than the industries engaged in the lower stages of production, like the mining and the converting of ore into pig iron. In pre-war German Lorraine it was principally the lower stages which were developed, and the crude iron was then sent into Germany to be turned into semi-finished and finished products. When the war was over, and Germany no longer took from Lorraine so great a quantity of ore and pig iron, production at these lower stages found no continued stimulus to further expansion. On the other hand steel production made a very rapid advance in view of the reconstruction needs of France and of the increased requirements of French industry during the post-war period:

Product	*Ratio of production in 1925 to production in 1913 in re-annexed Lorraine* [31]
Iron Ore	72%
Pig Iron	85
Crude Steel	115
Finished Steel	116

Thus Lorraine industry tended to become less bottom-heavy than it had been under the German régime. A similar tendency is observable in the rest of France, though to a less marked degree:

Product	*Ratio of production in 1925 to production in 1913 in France exclusive of Alsace-Lorraine* [32]
Iron Ore	93%
Pig Iron	100
Crude Steel	103
Finished Steel	126[a]

[a] Estimated only, because comparable statistics of output of finished products in Lorraine and in the rest of France were not available.

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[31] Association des Maîtres de Forges de Lorraine, *op. cit.*, pp. 13 and 19.

[32] Computed by deducting production in Lorraine from that of the whole of France.

In all of greater France the higher stages of metallurgical manufacture were undergoing rapid development. Such a tendency was of great economic advantage to the country. The exportation of advanced and finished products brought more profit than the exportation of raw and crude materials to be worked up elsewhere. Moreover, considerable economy was realized by the industrial integration which resulted from the annexing of steel plants and rolling mills to mines and blast furnaces. The only difficulty involved was that of obtaining sufficient coal, but that, as has been seen, was far from being insurmountable. In fact, the extent to which France carries on the higher stages of metallurgical production measures fairly accurately her degree of industrialization.

Foreign Trade in Iron and Steel

The increased output of iron and steel products, due partly to the reannexation of Alsace-Lorraine and partly to the recent development of the French steel industry, brought France face to face with the problem of marketing this tremendous output, since home industries were in a position to absorb only a part of it. The following column of figures indicates what success France had in selling her metallurgical products abroad:

Year	*Net exports of all iron and steel products* [33] *(In thousands of tons)*
1913 (not including Alsace-Lorraine)	211
1919 (including Alsace-Lorraine)	−1,814
1920 " " "	−1,248
1921 " " "	35
1922 " " "	239
1923 " " "	1,060
1924 " " "	1,480
1925 " " "	3,302
1926 " " "	3,544
1927 " " "	5,494

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[33] See Appendix C, p. 590. The 1927 figure was taken from *Statistique Mensuelle du Commerce Extérieur de la France.* The minus signs for 1919 and 1920 indicate an

It will be observed that in 1919 and 1920 France was obliged to import much more than she exported, but that was clearly due to the crippled state of her industry immediately after the war. Despite the serious competition she had to meet from Germany, whose money was depreciating constantly from 1921 to 1923, and despite difficulties she had to cope with during the occupation of the Ruhr, net exports increased steadily after 1921. It was particularly after 1924, when the metallurgical plants damaged during the war had been entirely reconstructed, that the gain was most marked. Other reasons for the extraordinary increase in the last three years considered were the inclusion of the foreign trade of the Saar with that of France after January 10, 1925, and the depreciation of the franc when the currencies of France's neighbors were being stabilized.

A more detailed analysis of French foreign trade reveals a tendency quite similar to that which was observed in the above study of production statistics. The increase in net exports was much greater in the case of the more advanced products than in that of the cruder products, as is shown in the table on the opposite page. And this seems to indicate that the stimulus to increased production of steel, especially in the latter post-war years, came very largely from the outside. While the increase in iron ore and pig iron net exports in 1927, as compared with 1913, amounted to 57 and 1150 per cent respectively, raw and semi-finished steel exports and finished steel net exports rose 855 per cent and 3840 per cent respectively in the same interval.

Consumption of Iron and Steel Products in France

The domestic consumption of iron and steel constitutes by the nature of things a more vital measure of the industrial development of France than her increased net exports of raw and partly manufactured metallurgical products. Consumption properly speaking

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excess of imports for those years. These figures include all items designated in French foreign trade statistics as "fers et aciers" and "produits des industries mécaniques" but they do not include pig iron or scrap. Some other metals and some wood are included in the "produits des industries mécaniques" but the proportion is probably very small.

NET EXPORTS OF IRON AND STEEL PRODUCTS

(In thousands of tons)

YEAR	IRON ORE	PIG IRON AND FERRO-ALLOYS	RAW AND SEMI-FINISHED STEEL [34]	FINISHED STEEL [35]
1913 (not including Alsace-Lorraine)	8,656	62	301	27
1919 (including Alsace-Lorraine)	1,396	20	−450[a]	−587[a]
1920 “	4,435	175	−61[a]	−314[a]
1921 “	4,841	629	438	−8[a]
1922 “	9,088	668	508	−76[a]
1923 “	9,318	544	667	80
1924 “	11,462	727	1,037	174
1925 “	7,985	657	2,109	575
1926 “	9,867	657	2,164	640
1927 “	13,615	775	2,873	1,057

[a] Excess of imports.

takes place only after the terminal processes of manufacture have been completed. Sometimes completion consists simply of casting near the blast furnace or the steel converter, sometimes it requires rolling or an initial forging, but usually completion demands cutting, shaping, planing, drilling, etc., which are the functions of the mechanical engineering industry. Thus consumption involves machines, automobiles, boilers and other highly manufactured metal goods as well as products of the metallurgical industries. The following column of figures shows the total consumption of iron and steel thus conceived and measured:

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[34] Designated in French foreign trade statistics as "brut en lingots" and "laminés ou forgés en blooms, billettes et barres."

[35] Designated in French foreign trade statistics as "acier fin pour outils," "aciers spéciaux," "fer ou acier machine," "feuillardes," "tôles planes," "bandes laminées à chaud," "fer étamé, etc.," "fil de fer et d'acier, etc.," "paille de fer," "rails de fer ou d'acier," "roues, bandages, etc.," and "essieux bruts ou travaillés."

Year	Estimated Consumption of Iron and Steel Products in France [36] (In thousands of tons)	Index Numbers of Consumption
1913 (not including Alsace-Lorraine)	5,563 [a]	100
1919 (including Alsace-Lorraine)	4,543	82
1920 " " "	4,413	79
1921 " " "	3,004	54
1922 " " "	4,783	86
1923 " " "	4,765	86
1924 " " "	6,470	116
1925 " " "	5,316 [b]	95 [b]
1926 " " "	6,482 [b]	117 [b]

[a] The error, from the comparative point of view, involved in the omission of Alsace-Lorraine is probably not very great, for if waste and double counting of scrap were eliminated from the computation, the consumption of finished goods in Alsace-Lorraine would have been, perhaps, quite small in proportion to the total consumption of France.

[b] These estimates are not wholly comparable with those of the previous years, because the foreign trade statistics which enter into their computation include the Saar. They are probably too low, because the net exports of France and the Saar combined were undoubtedly greater than the exports from France alone.

It will be observed that greater France in 1924 not only attained for the first time the level of consumption reached by France without Alsace-Lorraine in 1913, but exceeded it by about a sixth. Up to that time France was still in the throes of reconstruction, and in 1921 the business depression struck a severe blow to the consumption of iron and steel goods. The drop in 1925 and the lack of advance in the 1926 figure over that of 1924 are more apparent than real, being principally the result of the inclusion of the Saar in the foreign trade statistics from 1925 on. If the net exports of France alone (rather than those of France and the Saar combined) had been substracted from the production figures of France, the apparent consumption estimates for 1925 and 1926 would undoubtedly have been considerably higher.

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[36] The method of computation is described in Chapter VIII, p. 190, note 4.

An inherent weakness of the above consumption figures, if they are to be taken as indices of industrial activity, lies in the fact that they include consumers' as well as producers' goods. For example, the growing consumption of automobiles (consumers' goods) is more indicative of increasing wealth than of industrial development. On the other hand, an increased consumption of textile machinery, for instance, would show an intensification of manufacturing. In the following chapter other indices of iron and steel consumption will be discussed, but these bear specifically on the quantities absorbed by the metal-trades industries only.

The Effects of the Depreciation of the Currency on the Production and Consumption of Iron and Steel

It has been seen that as iron and steel production increased in France, both the foreign and domestic markets expanded their absorbing capacity. There were a number of factors that operated to bring about this development, which took place chiefly after 1924. Among the especially potent stimuli to production and trade was the influence of monetary inflation.

In a previous chapter,[37] the effects of inflation were treated in some detail in connection with the exports of merchant iron. It was there found that in the course of the inflation-deflation crisis from January 1925 to June 1927, the fall of the franc served as an encouragement more to internal consumption than to exportation, and the rise and *de facto* stabilization of the franc in late 1926 and in 1927 was coincident with an increase in exports. This was true over the short period of acute fluctuations, but it was none the less true during the longer period composed of all the post-war years under survey that French exports of metallurgical products increased more rapidly than internal consumption. This fact was certainly not unrelated to the discrepancy between the gold prices prevailing in France and the gold prices of the same metallurgical products on the international market, as the table on page 296 indicates.

Another reason for the extraordinarily rapid growth in exports was undoubtedly the reannexation of Alsace-Lorraine which liter-

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[37] See above, pp. 167–160

YEAR	INDEX NUMBER OF FRENCH CONSUMPTION OF IRON AND STEEL PRODUCTS [38]	INDEX NUMBER OF NET EXPORTS OF IRON AND STEEL PRODUCTS [39]	PRICE OF FOUNDRY PIG IRON ON FRENCH INTERNAL MARKET [40] (In dollars)	PRICE OF PIG IRON (BASIC) AT VALLEY FURNACES, PENN.[41] (In dollars)
1913	100	100	$15.80	$14.71
1920	79	...	38.15	42.21
1921	54	278	19.80	21.74
1922	86	278	19.00	24.20
1923	86	368	24.70	25.81
1924	116	441	18.00	20.24
1925	95	873 [a]	16.07	19.59
1926	117	854 [a]	15.90	18.55

[a] Saar included.

ally foisted upon France a metallurgical producing capacity entirely out of proportion with her consuming capacity. In seeking foreign markets for her surplus iron and steel products, France met with keen competition, especially from Germany and England, which at different times also enjoyed differential price advantages resulting from monetary depreciation. The fluctuations in steel production in all three countries, France, England, and Germany, showed a certain relationship not only to the changing value of their respective currencies, but to a great many other causes, as the analysis on the opposite page indicates.

The low French output at the beginning of the post-war period was due to the war damage done to the steel mills in the north of France. At that time France imported more than she exported. England's extraordinarily large production in 1920 was occasioned by her effort to meet the abnormal international demand for her steel which resulted from the disorganized state of industry in France and Germany. In 1921, 1922 and 1923, when France was gradually restoring her capacity of production so that she had a

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[38] See above, p. 294.

[39] See above, p. 190, note 4.

[40] *Annuaire Statistique, 1926*, p. 108, data given originally in francs were converted into dollars at yearly average of monthly exchange rates.

[41] U. S. Department of Commerce, *Commerce Yearbook, 1926*, Vol. I, p. 373.

INDEX NUMBERS OF STEEL PRODUCTION[42]

YEAR	FRANCE[43]	ENGLAND	GERMANY[43]
1913	100	100	100
1920	44	118	64
1921	45	48	76
1922	65	77	93
1923	73	110	52
1924	99	107	81
1925	106	97	100
1926	120	46	101

surplus for exportation, she had to sustain very keen competition from Germany, then enjoying the export advantages that go with currency depreciation. German competition was more detrimental to England than to France, because in the former country currency was being deflated at that time. Moreover, England's output was reduced by labor strikes. Germany, on the other hand, under the stimulus of inflation increased her output in 1922 by more than 45 per cent over that of 1920. In 1923, however, German production fell, the main reason being the occupation of the Ruhr and the resistance to it through strike methods. England's steel industry then took a sudden upward bound thanks to the crippling of her two main competitors by the Ruhr controversy. In 1924 French production was improving steadily and English production remained high while Germany was in the throes of a collapse of currency and stabilization. In 1925 and 1926 it was France's turn to experience the joys and sorrows of acute inflation, and at the same time England's trade was depressed owing to the sharp rise in her gold selling prices consequent upon her return to the gold standard. In 1926 England's steel industry was brought almost to a standstill as a result of the coal strike. By that time Germany was moving fairly rapidly along the road of industrial progress and was in a position to take advantage of Great Britain's distress. France then became Germany's more redoutable competitor not only because of the fall of the franc, which was a temporary phenomenon, but because of the new and improved status of the French steel industry. It is clear from the above account that it would be shortsighted to attempt to interpret production and trade movements of the post-war period in any country solely as a function of monetary inflation.

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[42] League of Nations, *Memorandum on the Iron and Steel Industry*, p. 47.

[43] Post-war areas.

It would be equally beside the mark to underestimate the influence of the depreciation of the franc on French steel production, since its effect on the domestic market was very considerable. The rising value in francs of many categories of securities, of wages and of commercial profits, and the fear of an ultimate collapse of the franc during acute inflation, stimulated domestic purchases and sales, and consequently industrial activity and the consumption of steel. Whether monetary depreciation affected the home market more than foreign markets or *vice versa* is most frequently impossible to determine in the absence of comparative statistics. So far as pig iron was concerned the consumption in greater France was larger in 1924 than in France and Alsace-Lorraine combined in 1913, while the amount exported was less.[44] For the more finished products, separate data of exports and imports of Alsace-Lorraine are not available, which renders accurate pre-war and post-war comparisons impossible. Perhaps the best indication of the relative influence of inflation on the domestic and foreign markets of France is found in the reaction that set in once deflation and *de facto* stabilization began. Although French steel production in 1927 remained about the same as it had been in 1926, net exports of raw and semi-finished steel rose 33 per cent and that of finished steel rose 65 per cent. Likewise the French production of pig iron remained practically stationary from 1926 to 1927, but net exports increased by 18 per cent. The domestic consumption of iron and steel apparently declined, therefore, once the spur of monetary depreciation was removed.

Conclusion

The future of French metallurgical production, especially so far as steel is concerned, will depend, in all probability, more on general international commercial and industrial conditions than on purely national circumstances. The International Steel Agreement,[45] of which France is a member, undertook on September 30, 1926, to determine quarterly a collective maximum production limit for its members, and to assign a proportional quota to each participant. The percentages allotted to the individual countries were to vary somewhat, depending upon the total amount produced. Thus if the aggregate annual production were to attain about 25 million tons, the share quota of each country was fixed as follows:[46]

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[44] See above, p. 283.

Germany	40.45%
France	31.89
Belgium	12.57
Luxemburg	8.55
Saar Territory	6.45

If the aggregate production decided upon should exceed 29 million tons, then the share quotas were to be:

Germany	43.18%
France	31.18
Belgium	11.56
Luxemburg	8.30
Saar Territory	5.78

In other words, the steel production of France, like that of the other members of the Agreement, became after the last quarter of 1926 a matter of international compromises and adjustments — at least theoretically; and it is likely that as time goes on the steel industry of continental Europe will envisage its manufacturing and sales problems more and more on an international basis.

During the post-war period, however, even after the Agreement had begun to function, each country was still pursuing its production policy as domestic conditions dictated despite penalties involved in cases of overproduction. This is quite clear from the discrepancy between quotas assigned and actual output, as is seen in the following table:

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[45] For the history and organization of this cartel see below, Chap. XVIII, pp. 570–574.

[46] League of Nations, *Memorandum on the Iron and Steel Industry*, p. 113.

QUOTAS AND PRODUCTION UNDER THE INTERNATIONAL STEEL AGREEMENT, OCTOBER 1926–JUNE 1927[47]

Country	Quota (In thousands of tons)	Actual Production (In thousands of tons)
Germany	9,320	11,685
France	6,729	6,262
Belgium	2,499	2,802
Luxemburg	1,795	1,811
Saar	1,245	1,386
Total	21,588	23,946

Undoubtedly if the International Steel Agreement should evolve into a vigorous cartel by really determining production, by fixing prices and by dividing markets, the international conditions affecting steel production in France would necessarily affect the whole metallurgical industry, since most of the pig iron produced is ultimately converted into steel and practically all crude steel must undergo further processes of manufacturing. In the period under survey, however, even after the Agreement had come into existence, French steel production and the entire metallurgical industry of France had still to cope with their difficulties from a national point of view.

The two major problems confronting French metallurgical manufacture in the post-war years were first, the question of an adequate supply of coke and coal, and second, that of finding satisfactory markets. These problems are not independent of each other, for England and Germany, which possess plentiful supplies of coke and coal of their own, enjoy on that account a differential advantage in competing with France for the sale of metallurgical products. Nevertheless, as has been seen, national borders rather than distance separate German coal from French iron, and international good will may go a long way to overcome the basic need of coke and coal in France. Furthermore, future inventions with regard to the use of more categories of coke in metallurgy may aid France to some extent. If free access to the Saar mines continues, and if the exploitation of the other coal resources of France is intensified, more ample quantities of coal may be available for carrying on and developing the higher metallurgical processes. Thus the coke and coal difficulties are far from being insurmountable.

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[47] Louis Domeratzky, "The Continental Steel Cartel," in the *Proceedings of the Academy of Political Science*, January, 1928, p. 109.

The problem of finding adequate markets may be partly solved by increasing domestic consumption. That there is room for such an increase is evident from the fact that the per capita consumption of iron and steel products in France is low as compared with that of other more highly industrialized countries. Such comparisons are likely to lead, however, to an overestimation of France's capacity to enlarge her consumption. With her nearly stable population she is not in the position of Germany, whose increasing number of inhabitants constantly calls for more steel. Nor can France be likened to new countries, such as the United States, which are still rapidly building new cities, new railways, new bridges, new ships, etc. France is already well supplied with these things. She could use considerably more steel for machinery. French agriculture could profitably employ, for example, a great deal more farm machinery than it does. The growing electrical and chemical industries are demanding increasing quantities of mechanical equipment and other metal products. The expanding French automobile industry also involves an enlarged consumption of steel.

The foreign markets to which France may look for the disposal of her surplus iron and steel are of a twofold character. There are, first of all, the metallurgical countries, like England, Germany and Belgium, with which the exchange traffic in metallurgical specialities is intense, and is likely to increase as their industry grows. This is simply a manifestation of the economic interdependence of industrially advanced countries. The other category of foreign markets consists of industrially backward countries, such as are found in Eastern and South-Central Europe. Their development in the post-war years was slow because they were particularly hard hit by the war. As they recover financially and economically, and as they build new factories and extend their urban agglomerations, they will have to seek their steel either in England or in the Ruhr-Lorraine region. A day will also come when the industrialization of Africa and Asia will provide France with important markets for her iron and steel production.

The French metallurgical industry has much to gain from a closer coöperation with other steel producing countries. The International Steel Agreement is but a step in that direction. Intimate collaboration between France and Germany would work for the mutual advantage of both countries, since the former would obtain coal and coke cheaply from the Ruhr and the latter would get iron ore from Lorraine, and both could interchange manufactured products on profitable terms. The lack of any international coördination in the early post-war period, when first one country and then another enlarged its production plant in order to take advantage of the temporary incapacities of other nations, resulted in an overequipment which was dangerous to the industry. Better coördination and collective planning ought to produce economies in production and sales.

The metallurgical industry in Europe had to bear the brunt of very violent economic, financial and even political disturbances during the post-war years. While England and Germany were suffering serious setbacks from time to time, French production continued to expand without interruption. Even the *de facto* stabilization of the franc in the latter half of 1926 and in 1927 caused no serious retardation in any branch of metallurgical production. It would appear from the foregoing analysis that the French iron and steel industries should continue to prosper in the calculable future.

CHAPTER XII

IRON AND STEEL II: THE MECHANICAL ENGINEERING INDUSTRIES

THE mechanical engineering industries comprise those branches of manufacture which are concerned with the production of machines and metal structures. The kinds of metals employed are legion, but the principal ones in the order of their importance are: steel, cast iron, weld iron and steel, copper and aluminum. In view of the fact that the amount of copper consumed in France since 1898 (excluding the war years) never in any one year exceeded three per cent of the raw steel consumed,[1] the mechanical engineering industries may well be regarded as consisting basically of the elaborative and finishing processes of iron and steel manufacture.

Exactly where the purely metallurgical phase ends and the mechanical engineering phase begins is exceedingly difficult to determine. In an automobile engine, for example, there are parts that are castings, made by pouring the molten pig iron or steel directly from the blast furnace or cupola or converter into suitable molds. There are parts that are forged pieces which are hammered into shape out of weld iron or steel as it comes from the puddling furnace. There are parts, also, that are made by rolling white hot ingots between cylinders until they take the desired form. These are generally counted as metallurgical products. Finally, the automobile engine contains parts that are made by cutting, planing, drilling, stamping, etc., semi-manufactured cast, forged or rolled pieces. These are, strictly speaking, mechanical engineering products. At each of the various stages of the elaboration of iron and steel, beginning with the smelting process, there are finished products, semi-manufactured products and products that are so rudimentary that they may be characterized as raw. The final assembled machine or structure often contains a combination of component elements which are the finished products of each stage. The line of demarcation between metallurgy and mechanical engineering is necessarily ragged and shadowy.

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[1] J. Dessirier, "Essai de détermination d'indices mensuels de la production industrielle en France," *Bulletin de la Statistique Générale de la France*, October, 1924, p. 104.

The branches of manufacture which make up the *ensemble* known as the mechanical engineering industries are highly complex and extremely varied. Their products include machinery, electrical apparatus, transportation equipment (such as railways, ships and automobiles), metallic structures and armaments. These industries range from the making of a simple screw to the laying of the hull of a 50,000-ton transatlantic liner. In some instances the finished products were known long before the corresponding engineering industry came into existence. Ships and bridges, for example, had been built by man thousands of years before iron and steel came to be used instead of wood and masonry. On the other hand, a great many finished products of the mechanical engineering processes owed their inception to the development of the technique of metal manufacturing. Thus the steam engine, the typewriter, the dynamo, etc., are acquisitions of a material civilization based upon iron and steel.

A perusal of the older statistics of the French gainfully occupied population reveals in a very striking way the recentness of the advent of some of the principal branches of the mechanical engineering industry. In the French census of 1901 automobiles were classed in the same category as small hardware (*petite quincaillerie*, *automobiles*, *etc.*), and in the sub-division of this category automobiles did not form an item apart, but were combined with bicycles. And this at an epoch when France was the foremost automobile manufacturer of the world!

1. Production in the French Mechanical Engineering Industries

It is possible to determine from official and private French statistics the amount of iron ore dug out of the mines, the quantity of cast iron, weld iron and steel produced, and also the weight of castings, rolled and forged products manufactured. Beyond that point, however, once the transitional frontier between metallurgy and mechanical engineering has been passed, no production figures exist for France.[2] One of the reasons for the availability of output data in the mining and metallurgical industries and for the complete absence of such data in the mechanical engineering industries, is the high degree of concentration of the former, and the extreme dispersion of the latter. The first gross elaborations of iron and steel take place in large sized plants where the quantities produced are easily measured thanks largely to the relative homogeneity of the product.

Year	*Number of metallurgical establishments in France*[3]	*Number of mechanical engineering establishments in France*[3]
1896 (without Alsace-Lorraine)	161	75,003
1901 " " "	157	77,528
1906 " " "	172	81,270
1921 " " "	253	80,246
1921 (including Alsace-Lorraine)	268	82,793

After the metallurgical processes have been completed, the semi-manufactured metal products are scattered among innumerable plants of different sizes ranging from a blacksmith's shop to a locomotive factory, and here precise measurement of production must necessarily cease. Obviously it would be impossible to totalize the exceedingly varied products of the metal trades industry.

There are, nevertheless, certain rough indications which give a fair notion of the general productive activity of the French mechanical engineering industries taken as a whole. First among these indices are the quantities of iron and steel which presumably find their way to mechanical engineering plants in France:

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[2] *Cf.* League of Nations, *Mechanical Engineering*, Vol. I, p. 68.

[3] *Résultats statistiques du Recensement général de la Population, 1906*, Vol. I, Part II, p. 186; and 1921, Vol. I, Part III, pp. 88 and 158. Establishments with no employees at all are excluded.

Year	*Apparent consumption of iron and steel by the mechanical engineering industries of France* [4] *(In thousands of tons)*
1910–1913 (average not including Alsace-Lorraine)	5,236
1910–1913 (average including Alsace-Lorraine)	5,587 [a]
1919 (including Alsace-Lorraine)	3,897
1920 " " "	3,967
1921 " " "	3,188
1922 " " "	5,567
1923 " " "	5,586
1924 " " "	7,186
1925 " " "	6,459
1926 " " "	7,544

[a] Computed by adding 6.7 per cent corresponding to the relation between the number of gainfully occupied persons in the metallurgical and mechanical engineering establishments in Alsace-Lorraine (German census 1907) and the number of persons similarly engaged in France (census 1906).

It is seen that as early as 1923 post-war France recovered the level of consumption of France and Alsace-Lorraine combined in the pre-war years. The 1925 and 1926 figures are probably underestimates, because the net exports of the Saar are included with those of France and subtracted from the production of France alone. That the recovery after 1923 was quite general in the mechanical engineering industries is seen in the figures of copper and aluminum consumption given on page 307. All the metal recorded in these tables as apparently consumed was not necessarily taken by mechanical engineering plants, unless such plants are conceived of as including kitchen utensil factories and the like. Moreover, a certain proportion of the raw metallurgical materials produced is not immediately transformed into consumable goods, but goes to constitute stocks in different places. Nothing is known regarding the quantity of these reserves at any time.

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[4] Computed by subtracting column 10 from column 8 of the table in Appendix C, p. 590.

YEAR	APPARENT CONSUMPTION[5] OF	
	COPPER (In thousands of tons)	ALUMINUM (In thousands of tons)
1910–1913 (average not including Alsace-Lorraine)	89.0	4.9
1910–1913 (average including Alsace-Lorraine)	95.0[a]	5.0[a]
1919 “ “ “ “	59.8	11.5
1920 “ “ “	32.8	11.1
1921 “ “ “ “	25.2	8.2
1922 “ “ “ “	62.0	5.9
1923 “ “ “ “	102.5	14.6
1924 “ “ “ “	134.2	16.7
1925 “ “ “ “	101.0	15.4

[a] Computed to include Alsace-Lorraine as in table, p. 306.

Shipbuilding and the Manufacture of Automobiles

There is only one branch of the mechanical engineering production, broadly construed, for which any statistics of output exist, and that is shipbuilding. Thanks to *Lloyd's Register of Shipping*, the number and gross tonnage of merchant vessels of 100 tons and upwards launched in France are known (see next page). These figures do not by any means represent all the shipbuilding activity of France, for war vessels are not included.

The post-war fluctuations in the output of French shipyards are rather curious because they are unlike the production movement in most French mechanical engineering or other industries. The peak year for shipbuilding was 1921, which for nearly all other branches of manufacture was the worst year of depression after the war. The reason for this anomaly lies in the particular vicissitudes of the international shipping situation ever since 1914. In the course of the years immediately preceding the outbreak of hostilities, the rate of increase in shipbuilding in France, as in

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[5] *Statistique de l'Industrie minérale.*

Year	Number and Gross Tonnage of Merchant Vessels of 100 Tons and Upwards Launched in France[6]	
	Number	Tonnage (In thousands of tons of vessel capacity)
1910–1913 (average not including Alsace-Lorraine)	75	123.3
1919 (including Alsace-Lorraine)	34	32.7
1920 “ “ “	50	93.4
1921 “ “ “	65	210.7
1922 “ “ “	62	184.5
1923 “ “ “	27	96.6
1924 “ “ “	26	79.7
1925 “ “ “	35	75.6
1926 “ “ “	34	121.3
1927 “ “ “	22	44.3

most countries, was such that it would probably have resulted in a falling off in subsequent demand if there had been no war.[7] So many ships were destroyed by enemy action from 1914 to 1918, however, that immense extensions of shipyard capacity took place in all shipbuilding countries. Whereas before the war France had 15 large yards in addition to a number of small general yards, during the post-war years under survey she possessed 19 large yards, 10 smaller ones for medium and small ships, and a great number of minor ones for fishing and sailing vessels, about 20 of which could build ships of over 200 tons. The estimated production capacity which had been roughly 300,000 tons before 1914 rose to 500,000 tons after the war.[8] The shipbuilding boom in France in 1921 and 1922 was simply the result of a universal effort to overcome arrears in construction, since the yards had been for several years chiefly engaged in naval repairs, in the conversion of craft and in the building of tramp tonnage for war supplies. As soon as the gaps were filled a severe depression set in. It is estimated, for example, that in 1924 French production, including about 25,000 gross tons for naval construction, amounted to approximately 105,000 tons, which meant that only 20 per cent of the shipbuilding capacity of France was utilized.

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[6] Since practically all the larger ships constructed in France in recent times are made of steel, the coefficient applied by the French customs authorities: 1 gross ton of vessel capacity of steel ships = 1000 kilograms of steel, may be utilized to determine the quantity of metal going into shipbuilding.

[7] League of Nations, *Shipbuilding*, p. 7.

[8] *Ibid.*, pp. 16–17.

The causes of the slump from 1923 on were manifold, but probably the principal one was that as a result of the execution of war-time emergency programs and as a consequence of the short-lived shipbuilding boom in the years immediately after the war, the world was saddled with a vessel capacity far in excess of the demands of sea-borne trade. The total merchant marine tonnage of the world rose from about 47 million tons in 1913 to 65 million tons in June 1923, that is, by more that 38 per cent. In the same interval the sea-borne traffic, as evidenced by the tonnage of vessel capacity entering and clearing the principal ports of Europe remained practically stationary, if it did not decline.

Among the reasons given for the contraction in the demand for tonnage are: the substitution of oil fuel for coal fuel in an increasing proportion of new ships, thus lessening the traffic in bunker coal; the overland deliveries of reparations coal from Germany which diminished the overseas demand of recipient countries; the decrease in coal cargoes due to increased economy in the utilization of coal and the adoption of alternative means of securing power on sea and land; the tendency to use liner tonnage instead of tramp tonnage for merchandise; and the general augmentation in the speed of vessels, increasing the number of trips made per year by individual ships.[9] In addition to these more special conditions affecting maritime traffic there was a world-wide depression in foreign trade during the post-war years. France's case, in particular, indicates how the tonnage capacity of her mercantile marine grew out of all proportion with the amount of sea-borne goods in foreign trade carried by foreign as well as French ships:

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[9] League of Nations, *Shipbuilding*, p. 27.

YEAR	WEIGHT OF SEA-BORNE FRENCH FOREIGN TRADE ENTERING AND CLEARING FRENCH PORTS[10] (In millions of tons)	GROSS TONNAGE OF FRENCH MERCHANT FLEET[11] (In thousands of tons of vessel capacity)
1910	32.2	1,452
1911	35.0	1,463
1912	35.2	2,053
1913	40.0	2,201
1919	35.3	2,234
1920	39.4	3,245
1921	27.9	3,652
1922	37.0	3,846
1923	44.4	3,737
1924	43.6	3,498
1925	37.9	3,512
1926	34.5	3,491

The post-war carrying capacity of the French merchant fleet was about 75 per cent higher than it had been before the war, while the merchandise passing in and out of French ports was in the peak year (1923) only 11 per cent greater than in 1913, and in most post-war years it was less than in 1913. Under the circumstances it is not at all surprising that there should have been a decline in shipbuilding after 1923. 1926 was an exceptional year because internal demand was greatly stimulated by monetary conditions. In 1927 the slump reasserted itself more unmistakably than ever.

Since shipbuilding constitutes a finishing or assembling stage in the elaboration of iron and steel, and since its raw material consists mainly of semi-manufactured steel, its relative importance among the mechanical engineering industries may be measured by the ratio of the estimated amount of steel going into shipbuilding to the total quantity of iron and steel apparently consumed by all mechanical engineering plants:[12]

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[10] *Tableau général du Commerce et de la Navigation.* The figures of the "commerce général" were preferred to those of the "commerce spécial" because the former represent the total sea traffic, including goods passing through France for transit or temporary storage only.

[11] *Lloyd's Register.*

[12] See above, p. 306.

Year	*Proportion of steel consumed by shipbuilding*[13] *to total iron and steel apparently consumed by the French mechanical engineering industries*
1910–1913 (average)	2.4%
1919	.8
1920	2.3
1921	6.6
1922	3.3
1923	1.7
1924	1.1
1925	1.2
1926	1.9

Thus shipbuilding does not loom very large among the steel and iron consuming industries of France.

As shipbuilding is alone among the mechanical engineering industries in possessing quantitative production data, it is impossible to determine how much more important any other branch of manufacture of iron and steel products may be. There are, for instance, no statistics shedding direct light on French automobile output. Nevertheless M. Dessirier was able to devise a series of suggestive index numbers of production based on permits issued in the département of the Seine for new passenger cars and trucks:

Year	*Dessirier index number of automobile production*[14]
1913	100
1921	269
1922	312
1923	384
1924	510
1925	546
1926	600

[13] See above, p. 308, note 6.

[14] See Appendix B, p. 586. *Bulletin de la Statistique Générale de la France,* July–Sept. 1927, p. 350, footnote 1.

Obviously these indications are only approximate. They show, nevertheless, that there was a steady post-war increase in production, which doubled from 1922 to 1926. There is no way of telling how much steel, or any other material, was consumed by automobile manufacturers, but undoubtedly large quantities of metallurgical products, principally steel, were transformed in this way.

Mr. Cahill cites estimates according to which France is said to have produced between 150,000 and 170,000 automobiles in 1924, about 205,000 in 1925, and between 240,000 and 250,000 in 1926.[15] These figures contrast strikingly with the pre-war production estimated by the Ministry of Commerce at 45,000 automobiles,[16] but that is not at all surprising in view of the fact that throughout the world there has been a tremendous increase in the production and utilization of motor vehicles.

There are reasons to believe that the expansion in French automobile manufacturing may not continue at the same pace, even though there was in France in 1926 one automobile to every 53 inhabitants, while at the same time there was one to every 6 inhabitants in the United States.[17] Among the larger European countries, where conditions of manufacturing and motor transport are more or less alike and therefore comparable, France stands out as first in rank with respect to the density of automobiles per units of population. England had one automobile for every 55 inhabitants in 1926, Belgium one for every 84 inhabitants, Germany one for every 193; and Italy one for every 346. Only Denmark in continental Europe was slightly ahead of France, with one for every 51 inhabitants.

The 751,000 automobiles in circulation in France in 1925 may therefore be considered as fairly near the saturation point for internal consumption.[18] The only opportunity France may have of expanding output in the calculable future will be through the development of foreign markets in Germany (where there is little automobile production), in Russia and in North Africa. Everywhere, however, she will have to meet with severe competition from the United States whose mass production under the stimulus of an immense domestic market has been pushed so far as to make American automobiles the cheapest in the world.

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[15] J. R. Cahill, *Report on the Economic and Industrial Conditions in France, 1925–1926*, p. 121.

[16] Ministère du Commerce, *Rapport général sur l'Industrie française*, Vol. I, p. 369.

[17] *Statistical Abstract of the United States, 1925*, p. 368.

[18] *Annuaire Statistique, 1926*, p. 68.

Progress in the Manufacture of Mechanical Engineering Products in France

In order to obtain an index number which would reflect as accurately as possible the growing productive activity of the mechanical engineering industry taken as a whole, M. Dessirier combined by averaging, after proper weighting, all the available data bearing on the consumption of raw steel,[19] on the consumption of copper and finally on shipbuilding. In order to make his pre-war and post-war results comparable, the estimated production in Alsace-Lorraine was added to the 1913 production of France:[20]

Year	*Dessirier index number of production in the mechanical engineering industry*[21]
1913 (including Alsace-Lorraine)	100
1919 " " "	57
1920 " " "	64
1921 " " "	59
1922 " " "	80
1923 " " "	90
1924 " " "	121
1925 " " "	115
1926 " " "	130
1927 " " "	114[a]

[a] *Bulletin de la Statistique Générale de la France*, January–March 1928, p. 123. This index number is not strictly comparable with the preceding ones because it was computed in a slightly different way.

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[19] Computed somewhat differently from the iron and steel consumption figures given above.

[20] See above, p. 306, note *a*.

[21] See Appendix B, p. 586

The League of Nations' *Memorandum on the Iron and Steel Industry* also gives a series of estimates of the French consumption of iron and steel, most of which goes to the mechanical engineering industry.[22] These figures differ from M. Dessirier's estimates in that they include, in addition to raw steel, the production of pig iron not used in making steel:

Year	*League of Nations' estimate of iron and steel consumption (In thousands of tons)*
1913 (not including Alsace-Lorraine)	6,005
1923 (including Alsace-Lorraine and the Saar)	6,890
1924 " " " " " "	9,255
1925 " " " " " "	8,299

These figures are necessarily of but limited interest, because the pre-war and post-war estimates refer to different areas. Their chief value lies in the fact that they are presented with consumption estimates constructed in a similar manner for other countries. The international comparisons of the per capita consumption of iron and steel are shown in the following table:

COUNTRY	PER CAPITA CONSUMPTION OF IRON AND STEEL (In kilograms)			
	1913	1923	1924	1925
	(Pre-war territory)	(Post-war territory)		
France	151	170 [a]	228 [a]	203 [a]
United States	272	468	387	468
Belgium	190	182 [b]	254 [b]	255 [b]
Great Britain	236 [c]	207 [d]	224 [d]	200 [d]
Germany	261	125	174	197
Sweden	151	80	133	119
Italy	38	34	40	61

[a] Including the Saar.
[b] Including the Duchy of Luxemburg.
[c] Including Ireland.
[d] Excluding Irish Free State.

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[22] Pp. 32–33.

It will be observed that the French per capita consumption in the peak year (1924) was 51 per cent higher than in the last pre-war year, while Belgium's highest post-war consumption was only 34 per cent higher, and Great Britain's, Germany's and Sweden's per capita consumption after the war were all lower than in 1913. Only the United States and Italy in the above list showed greater progress than France, and Italy's consumption bears on so relatively small a quantity as to make proportionally large increases of little consequence.

The same League of Nations publication estimates the relative position of France as a producer of machinery, and these figures were found acceptable, with only minor reservations, by the French organizations representative of the mechanical engineering industry of the country:[23]

COUNTRY	PERCENTAGE OF WORLD OUTPUT OF MACHINES	
	1913	1925
United States	50.0	57.6
Great Britain	11.8	13.6
Germany	20.6	13.1
Canada	2.4	3.2
France	1.9	2.4
Russia	3.5	1.8
Austria-Hungary [24]	3.4	1.5
Other Countries	6.4	6.8
	100.0	100.0

Thus France's position moved up after the war from eighth in rank among the machine manufacturing countries to fifth, as her proportional contribution to the world output rose from 1.9 to 2.4 per cent. Nor was this shift due simply to a contraction of production in Russia and in the Succession States of the former Austro-Hungarian Empire, for it is estimated that the French machine output of 1925 was just about double that of 1913.[25]

[23] The *Memorandum on the Iron and Steel Industry* was prepared by Dr. Karl Lange for "Verein Deutscher Maschinenbau-Anstalten," pp. 29–30 and 181–184.

[24] Succession States after the war.

[25] *Op. cit.*, p. 68.

All the data considered up to this point, bearing on the productive activity of the French mechanical engineering industries in general, agree in showing a serious decline in output during the early years after the war in comparison with pre-war production. This is certainly not to be attributed to any diminution in manufacturing capacity resulting from war damage in the north. On the contrary, since mechanical engineering factories had always been fairly evenly spread over the surface of France, and since those outside of the war zone had increased their plant equipment enormously in the course of hostilities in order to meet the extraordinary demand for armaments, France and Alsace-Lorraine together possessed in 1919 an unprecedentedly large production capacity. The slump from 1919 to 1922 was due to the sudden cessation of nearly all armament orders which threw into idleness a great quantity of productive equipment. Some plants were even dismantled. In fact, it required several years, during which the 1921–1922 crisis aggravated the situation, to effect a readjustment of this industry from war-time to normal peace-time production.

Both the Dessirier index number of production in the mechanical engineering industry and the apparent consumption of iron and steel indicate a resumption of the upward trend from 1922 on. In 1923 or 1924 the pre-war level of production was attained again and from 1924 on the rate of output was from 15 to 35 per cent greater than it had been before the war. It appears that the machine producing, automobile manufacturing, shipbuilding and other fabricated metal goods industries were particularly sensitive to the stimulus of monetary depreciation, because in 1926 there was, by every sign and measurement, a very marked expansion in production. That this sudden rise was due in large part to inflation — that is to say, to the rush, especially on the internal market, to invest money in automobiles, machinery and other metal articles representing permanent value when the franc was falling — is quite evident from the fact that the output shrank in 1927. Nevertheless, in spite of the 1927 slump, the volume of production was still, according to the Dessirier index number, considerably greater than it had been in 1913, even when the same area of greater France is compared both before and after the war. It appears, therefore, that the post-war expansion in the French mechanical engineering industries is not a temporary phenomenon, but an element of definitive industrial progress.

Unlike the metallurgical industry, the mechanical engineering industries of France do not owe their growth principally to the reannexation of Alsace-Lorraine. The recovered provinces, as it has been seen in the previous chapter, were far more developed in the lower stages of metal elaboration than in machine making and similar branches of manufacturing. As was shown in the 1921 census, the number of persons gainfully occupied in metallurgy in Alsace-Lorraine represented more than 30 per cent of the number of persons similarly occupied in the rest of France, while the number of persons gainfully occupied in mechanical engineering, broadly speaking, represented only 3.5 per cent of the number of persons similarly engaged in the rest of France.[26]

It was the war which was directly responsible for the development of the French mechanical engineering industries not only as regards the scale of output, but also the size of plants and the more advanced technique of production. The larger automobile factories employing from 20,000 to 30,000 workers, for example, first attained these proportions in the manufacture of armament equipment during hostilities. The machine tool industries were also stimulated by the war, because France was at that time producing extraordinarily large quantities of high speed, special and electric steels. Perhaps a more indirect consequence of the war was the reorganization on larger lines of plants producing machinery for mines and sugar refineries and heavy factory equipment, in view of the requirements for the industrial reconstruction of the devastated regions. Moreover, the additional iron ore and pig iron resources which came to France as a result of the war inspired the metallurgical firms that were integrating their production with the manufacture of metal goods to expand their mechanical engineering plants, since the raw materials were plentiful and easily available.

[26] *Résultats statistiques du Recensement général de la Population, 1921*, Vol. I, Part III, pp. 85 and 156, under rubrics: "métallurgie" and "métaux ordinaires."

Plant Concentration and Gainfully Occupied Population

As a result of these influences the mechanical engineering industry underwent an important transformation in the direction of concentration, though by and large it still remained, even in the post-war years, one in which small-scale plants were the most prevalent. The progress in concentration is shown in the following table:

Year	Percentage of Engineering Establishments Employing More than 500 Workers[27]	Proportion of Total Number of Mechanical Engineering Employees in Establishments of over 500 Workers
1901 (without Alsace-Lorraine)	.12	....[a]
1906 " " "	.15	24.0
1921 " " "	.30	33.7
1921 (including Alsace-Lorraine)	.30	34.0

[a] Unavailable.

Not only did the number of larger establishments in proportion to the total number double from 1906 to 1921, but they absorbed more that a third of all the wage earners in the metal working trades in 1921, whereas before the war they had absorbed less than a a quarter. In absolute terms the number of establishments employing more than 500 workers advanced from 120 in 1906, not including Alsace-Lorraine, to 241 in 1921 within a similar area, and to 250 in 1921 in an area including Alsace-Lorraine. It is clear also, from the above table, that Alsace-Lorraine contributed little to the general state of concentration of these industries in France. That small-scale plants still constituted the vast majority of mechanical engineering establishments in France and at the same time absorbed a large part of the working population in these trades is seen in the following figures:

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[27] *Résultats statistiques du Recensement général de la Population, 1906*, Vol. I, Part II, and 1921, Vol. I, Part III; under rubric 4L, designated as "métaux ordinaires."

Year	Percentage of Mechanical Engineering Establishments Employing 100 or Less Workers[28]	Proportion of Total Number of Mechanical Engineering Employees in Establishments of 100 or Less Workers
1901 (without Alsace-Lorraine)	99.1	56.0
1906 " " "	99.1	53.1
1921 " " "	98.2	41.4
1921 (including Alsace-Lorraine)	98.2	41.1

Nevertheless the evolution towards concentration is obvious from the fact that before the war more than half of the wage earners in these industries were employed in establishments of less than 100 workers, while after the war this proportion was considerably reduced. The 1926 census will undoubtedly show an even more marked diminution in the importance of smaller-sized plants.

The shift in the relative position of the mechanical engineering industry among the various branches of manufacture in France is no less indicative of the progress of the metal working trades (exclusive of metallurgy) and also of the general industrial advance of the country:

Industry	Percentage of Total Industrial Population[28]				
	1896	1901	1906	1921 (without Alsace-Lorraine)	1921 (with Alsace-Lorraine)
Mechanical Engineering	9.6	10.1	10.5	15.7	15.5
Clothing	20.5	21.3	21.5	16.0	15.6
Textiles	14.2	12.8	12.7	9.8	10.1
Woodwork	10.7	10.2	9.8	8.5	8.3

[28] *Ibid.*

It will be seen that mechanical engineering moved from fourth place among the more comprehensive categories of French industry in 1896 and in 1901 to third place in 1906, and finally to second place — indeed very close to first — in 1921. Alsace-Lorraine made no very perceptible difference in this ranking. The above table is also interesting in showing how the substitution of metal for wood in recent building practice and for many other purposes brought about an inversion in the comparative importance of the wood-working and metal-working trades between 1896 and 1921.

In absolute terms the increase in the number of persons gainfully occupied was even more striking:

Year	*Persons gainfully occupied in the mechanical engineering industry*
1896 (without Alsace-Lorraine)	607,695
1901 " " "	707,607
1906 " " "	758,377
1921 " " "	1,170,044
1921 (with Alsace-Lorraine)	1,211,456

In 1921 there were 54 per cent more persons gainfully occupied in the mechanical engineering industry in France, exclusive of Alsace-Lorraine, than there had been within the same area in 1906.[29] The increase in the decade from 1896 to 1906 was only of the measure of 25 per cent. It is not from these figures, however, that one can obtain an adequate idea of the growth in output capacity of French mechanical construction, since at the same time as the number of persons gainfully occupied increased, progress in technique, in machinery, and in factory organization brought about an aggrandizement in production more than proportional to the number of persons occupied in this branch of manufacture. That explains why, on the basis of the Dessirier index, the output nearly quadrupled from 1898 to 1926, while the gainfully occupied mechanical engineering population only doubled.

Up to this point the mechanical engineering industry has been very broadly construed as including all manufacture of metal goods beyond the metallurgical stage. In a narrower, and perhaps more commonly accepted, sense the mechanical engineering industry may be defined as comprising those branches of manufacture which produce machines, machine tools, electrical apparatus and equipment. Even within this more restricted field there are no production data. The only available indication of the significance of these industries in the industrial *ensemble* of France is to be found in the census figures which show that they occupied 540,500 persons in 1921 in greater France, or about 7 per cent of the whole industrial population of the country.[30]

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[29] Comparisons between greater France in 1921 and France and Alsace-Lorraine in 1906 are impossible because the German census of 1907 combined metallurgy and mechanical engineering.

Taken together the industrial population engaged in manufacturing machinery and electrical apparatus constituted a very considerable mass, but it was spread over 24,311 plants of which but 151 had more than 500 workers each, while 670 had no workers at all, being tiny shops in which the owners did all the manufacturing single-handed. Yet the bulk of this branch of production was carried on in medium-sized plants, as is shown by the fact that a third of the wage earners were to be found in industrial units of 100 or fewer workers.

Geographic Distribution

The geographic distribution of plants for machines and electrical apparatus seems at first sight an anomaly. One would expect these industries to be concentrated in the north and in Lorraine, close to the metallurgical centers. Such, however, is not the case. Unlike the French silk industry which belongs to Lyons and its environs, unlike the French woolen industry which has its main center in Roubaix-Tourcoing, the French machinery industry converges in no one particular region.

The Paris basin is undoubtedly the outstanding point of concentration for the manufacture of machines and electrical equipment in France. According to the 1921 census there were at that time in Paris and its suburbs 188,000 persons thus engaged, representing 35 per cent of the country's total population working in these industries.[31] Next in importance is the region in the center of France embracing the cities of Lyons, St. Étienne and Grenoble where over 55,000 persons were gainfully occupied in 1921 in the industries under discussion.[32] Still another machine and electrical goods manufacturing area is found in the east of France, with nuclei in Nancy, Strasbourg and Belfort, where mechanical engineering firms, in the narrow sense of the term, employed in 1921 about 38,000 persons.[33] Finally there is the industrial north, counting in 1921 about 38,300 persons in machine-making and electrical equipment plants, clustering principally around the cities of Maubeuge, Valenciennes, Lille and Tourcoing.

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[30] *Résultats statistiques du Recensement général de la Population, 1921*, Vol. I, Part III, under rubrics 4Lf3 and 4Lg designated as "mécanique" and "appareils éléctriques."

These four fairly wide regions contained altogether about 320,000 persons gainfully occupied in 9,357 establishments of the machine construction and electrical goods categories. The remaining 40 per cent of the industrial population in these groups, and 62 per cent of the establishments, were scattered over the rest of France. There is an appreciable amount of geographic concentration around the principal seaports, such as Marseilles, Bordeaux, Nantes, Cherbourg, Le Havre and Dunkirk. And inland, also, there is not a city of any rank without some engineering plants. Dijon, Auxerre, Clermont, Tours, Rouen, Toulouse, Amiens, Limoges and Rennes all produce machines of one kind or another mainly for local consumption.

The apparently illogical dispersion of the machine-making industry is due to causes deeply rooted in the industrial past of the country, since most manufacturing plants in France were built a long time ago, many going back a century or more. Some found their present location because of their nearness to markets when they were established, others were erected in given places because of their propinquity or easy access to raw materials at that time. It must be remembered that in the course of the nineteenth century the metallurgical centers — whence the principal raw materials for the mechanical engineering industries come — shifted their positions on several occasions. At the opening of the last century, when the predominant blast-furnace fuel was still wood in the form of charcoal, the production of iron and metal goods took place chiefly near forests where wood was abundant and near water courses where hydraulic power was to be had for working the bellows. In 1864, however, when only 85,000 tons out of a total of 791,000 tons of pig iron were produced in charcoal blast furnaces, metallurgy and its satellite industries gravitated towards coal mines, or towards places where coal and coke could be brought cheaply and easily by rail or water.[34] Such localities were to be found in the center of France, at Creusot, for example, in the départements of Gard and Aveyron of the south, and also in the north and east of France.

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[31] *Résultats statistiques du Recensement général de la Population*, Vol. II in Seine (Ville de Paris) and Seine (banlieue de Paris).

[32] *Ibid.*, in the départements of the Rhône, Isère and the Loire.

[33] In the départements of Meurthe-et-Moselle, Vosges, Bas-Rhin, Haut-Rhin, and the Territory of Belfort.

The exceptional importance of the east, which includes Lorraine, was totally unsuspected until the last quarter of the nineteenth century, when the Thomas basic process made possible the utilization of phosphorus-bearing ores in the manufacture of steel. By that time a large part of Lorraine was lost to France. The reannexation of the département of Moselle in 1918 and the consequent consolidation of the principal metallurgical region of continental Europe within French frontiers were too recent to give rise to a geographic readjustment of the mechanical engineering industries in the post-war period. In fact, there was hardly a perceptible tendency in the direction of bringing the machine-making and electrical equipment factories closer to the principal source of raw materials where they might become concentrated and produce on a larger scale. Tradition had laid its hand too heavily on French industry to permit of a rapid change.

Another reason for the extreme subdivision and geographic scattering of the mechanical engineering plants of France is the wide diversity of products which require highly specialized factories that need to be close to very different kinds of markets. The manufacture of mine and blast furnace machinery is totally unlike that of textile machinery, and the centers where these products are sold are most often far apart from each other. Automobile engines, that are turned out in large quantities with stereotyped regularity, under a proper system of rational management and planning, are most economically produced in large industrial agglomerations where labor is plentiful and where, at the same time, the automobile markets are most important. On the other hand, gigantic units of power machinery that keep, for example, a thousand looms in action or furnish electrical energy for vast aggregations of factories and homes, are not made in advance or under standardized conditions, but are manufactured to order and to measure — their very smallest parts being often cast and forged according to specifications. The plants engaged in this branch of manufacture, which are few in number and very large, are usually found near coal and pig iron, since they consume these raw materials in great quantities. Their market is the whole country.

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[34] J. Levainville, *L'Industrie du Fer en France*, p. 66.

The inordinate subdivision and scattering of French mechanical engineering plants and the indescribable diversity of their products proved to be a great element of weakness for the industry as a whole. It was practically impossible for the manufacturers, who were extremely numerous, and who produced dissimilar goods in very disparate factories and shops, to get together and further their common interests, as could the few great pig iron and raw steel manufacturers of the country.[35] The national trade associations that exist, like the *Fédération des Syndicats de la Construction Mécanique, Éléctrique et Métallique de France*, the *Union des Industries Métalliques et Minières*, and the *Chambre Syndicale de Fabricants et de Constructeurs de Matériel pour Chemins de Fer et Tramways* are interested mainly in labor, social and fiscal questions, and do little or nothing to standardize production and break down the general dispersion of the industry which is the cause of considerable waste and duplication of productive effort.

2. FOREIGN TRADE IN MECHANICAL ENGINEERING PRODUCTS

Neither the vague production data available, nor the industrial census figures, nor whatever evidences there are of progress in concentration, show the post-war growth in the mechanical engineering industry as vividly and as strikingly as foreign trade statistics. On the eve of the war France was becoming increasingly dependent on outside sources for her supply of manufactured metal goods, as the excess of imports in weight of these products shows:

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[35] E. Dalbouze, "Le Développement des Industries mécaniques en France," in *L'Illustration Économique et Financière*, special number, December 11, 1926, pp. 50–54.

Year	*Excess of imports of mechanical engineering products* [36] *(In thousands of tons)*
1910 (not including Alsace-Lorraine)	3
1911 “ “ “ “	68
1912 “ “ “ “	54
1913 “ “ “ “	144

The post-war figures, on the other hand, reveal a complete reversal of the situation from 1923 on, once reconstruction began to near completion:

Year	*Excess of exports of mechanical engineering products* [36] *(In thousands of tons)*
1919 (including Alsace-Lorraine)	−558
1920 “ “ “	−817
1921 “ “ “	−335
1922 “ “ “	−218
1923 “ “ “	236
1924 “ “ “	259
1925 (including also the Saar)	616
1926 “ “ “ “	839
1927 “ “ “ “	1,213

The significance of the change is twofold, indicating a greater self-sufficiency on the part of home industry and an impressive expansion of the foreign market. Although imports declined much less rapidly than exports increased, nevertheless, in view of the fact that the domestic demand for machinery and other metal goods must have been constantly rising with the general post-war amplification of productive activity, the mere absence of any increase in imports would be sufficient to show that the French mechanical engineering industry was becoming more and more capable of meeting the country's needs.

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[36] See *Stat. Mens. Com. Ext.;* the – sign indicates an excess of imports.

The increase in exports from 1913 to 1926–1927 did not mean, as might at first be supposed, that France had succeeded in capturing vast foreign markets for her engineering products, thus becoming a great exporting country. It was estimated before the war that exported metal goods represented about 10 per cent in value of the national output. At that time Germany was said to be exporting a third of her production, England 43 per cent, and Belgium 80 per cent.[37] In 1927, the proportion of the value of the total French production which was exported was still computed roughly at only 10 per cent.[38] Moreover, as the following table shows, the machinery exports from France even after the war formed a much smaller part of the total exports than from other important machine producing countries:

EXPORTING COUNTRY	RATIO OF VALUE OF MACHINE EXPORTS TO VALUE OF ALL EXPORTS [39]	
	1913	1925
United States	26.8%	34.8%
Great Britain	28.4	24.4
Germany	29.0	20.0
France	3.0	4.6
Switzerland	2.5	3.4
Belgium	2.5	1.6

Nevertheless, in 1925 and 1926 as in 1913 mechanical engineering products taken as a whole[40] formed the second largest category in value among the groups of fabricated articles exported from France. On the import side of the foreign trade balance sheet, mechanical engineering products in point of value surpassed any other group item.

An examination of the more detailed foreign trade figures not only reveals the fortunes of individual French metal products on the international market, but reflects more or less accurately the situation of the particular mechanical engineering industry engaged in the manufacture of a given machine or other fabricated metal product. The exports and imports of electrical goods, for example, confirm the progress which the industries concerned undoubtedly made during the post-war period. As was seen in a previous chapter, the rapidly increasing use of electricity in France and the development of water and thermic power production for electrical current stimulated the French consumption of dynamos, cables, and other apparatus.[41] It is obvious from the following table, which shows a decrease in imports in the course of the latter post-war years even below the prevailing pre-war level and at the same time a tripling of exports, that the domestic electrical equipment industry supplied most French requirements and had a fairly large surplus to export:

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[37] Levainville, *op. cit.*, p. 182.

[38] Communicated by the Syndicat des Industries Mécaniques.

[39] League of Nations, *Mechanical Engineering*, Vol. I, p. 46.

[40] Designated in French foreign trade statistics as "produits des industries mécaniques."

FOREIGN TRADE IN ELECTRICAL MATERIAL[42]

(In tons)

Year	Imports	Exports
1910	5,283	4,710
1911	6,971	6,053
1912	7,124	4,843
1913	7,827	5,515
1919	8,093	3,634
1920	10,818	8,646
1921	9,366	8,284
1922	6,537	9,134
1923	6,991	9,890
1924	5,296	16,504
1925	5,377	13,734
1926	4,143	16,167
1927	6,017	18,014

In an industry of this kind, where new inventions crop up with disconcerting rapidity, it would be rash to speak of any definite tendency. Still, although wireless material constitutes a new rubric in French foreign trade statistics only since 1926, it reflects the same general movement towards national self-sufficiency and an expanding export market, the imports having been only 10 and 59 tons in 1926 and 1927 respectively, while exports amounted to 1,373 tons in 1926 and 763 tons in 1927.

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[41] See above, pp. 262–267.

[42] Includes items designated in French foreign trade statistics as: "machines dynamo-électriques," "appareils électriques et électro-techniques," "bâtis et carcasses de dynamos et de moteurs électriques," "fils et cables isolés pour l'électricité" and "lampes électriques à arc et pièces détachées en fer ou en acier."

Another relatively new branch of the mechanical engineering industry, the increased exports of which are clear manifestations of expanding production, is the automobile industry. In fact, it is said that before the war about half of the motor vehicle output of France went abroad,[43] and that since the war from a third to two-fifths were exported.[44] This is a large proportion, and it explains why the French look upon automobile manufacturing as an exporting industry. It will be seen in the following table that automobile exports increased in weight almost fourfold, from 1913 to 1926:

YEAR	AUTOMOBILE EXPORTS[45] (In tons)		
	Passenger Cars	Trucks and Commercial Cars	Total
1910	17,661	488	18,149
1911	17,559	726	18,285
1912	23,011	816	23,827
1913	24,170	1,654	25,824
1919	2,390	3,520	5,910
1920	29,990	21,426	51,416
1921	23,847	13,735	37,582
1922	20,185	13,926	34,111
1923	33,852	6,906	40,758
1924	51,491	10,331	61,822
1925	66,563	10,954	77,517
1926	83,232	13,750	96,982
1927	86,184	11,978	98,162

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[43] J. R. Cahill, *Report on Economic Conditions in France, 1923*, p. 49.

[44] P. Didier, "L'Industrie automobile," in the *Revue Syndicale de Documentation Économique*, April 1927, p. 155.

[45] Designated in French foreign trade statistics as "Carrosserie, voitures automobiles."

The rapidity with which these exports attained and even surpassed the pre-war volume is very clearly indicative of the fact that the French automobile industry was favorably, rather than adversely, affected in its productive capacity by the war. As early as 1919 France exported more than twice the weight of motor trucks sold abroad in 1913; and in 1920 she exported twice the weight of all automobiles sent to foreign markets in 1913. When the business depression of 1921 and 1922 followed, automobile exports declined, but only in the case of passenger cars below the 1913 level. After that the growth was steady, perhaps slightly accelerated in 1926 by monetary depression, as the decline in motor truck exports in 1927 shows. Still, taken altogether, it appears that the French hold on foreign outlets is a real commercial and industrial asset, quite independent of monetary accidents.

Although the movement of imports in automobiles was very erratic in the post-war period, there was no definite tendency towards a decline. Instead of falling below the pre-war level, as exports increased, the weight of automobiles imported from 1922 to 1927 remained between three and ten times that in 1913:

YEAR	AUTOMOBILE IMPORTS (In tons)		
	Passenger Cars	Trucks and Commercial Cars	Total
1910	966	32	998
1911	1,281	7	1,288
1912	1,513	103	1,616
1913	2,199	6	2,205
1919	781	22,590	23,371
1920	892	11,688	12,580
1921	2,996	163	3,159
1922	10,647	106	10,753
1923	11,549	183	11,732
1924	17,469	358	17,827
1925	22,591	536	23,127
1926	14,706	142	14,848
1927	7,614	544	8,158

The relatively small part which trucks and commercial cars played in these imports after 1920 implies a general self-sufficiency of French industry in this respect. On the other hand, the large volume of imports of passenger cars after the war, while always representing but a small percentage of the constantly increasing exports, means that there must be a gap in some phase of French passenger and automobile production. A comparison of the price per ton of imports and of exports throws light on this subject:

Year	Price per Ton of Passenger Automobiles in French Foreign Trade [46]	
	Imports	Exports
1913	8,000 francs	9,000 francs
1922	6,000	20,000
1923	5,200	21,500
1924	6,200	26,500
1925	7,100	29,500
1926	9,700	28,200
1927	14,900	18,100

The fluctuating value of the franc renders the year-to-year movement in the price per ton of passenger automobiles in either imports or exports of little significance. The great superiority in the price per ton of exports over imports, however, shows that, both before and after the war, France specialized in exporting relatively expensive automobiles and imported relatively cheap ones. This fact indicates quite clearly that the gap in French production lay in the manufacture of low priced cars. The French automobile industry was conceived of from the beginning as an *industrie de luxe*. But times are changing the world over. Although in 1927 the franc was much higher than in 1926, which would tend to make imports of the same category cheaper in francs per ton, provided international gold prices remained stable, the discrepancy between import and export prices tended to diminish. The foreign trade figures of the last year available (1927) indicate that the

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[46] See *Stat. Mens. Com. Ext.*

French automobile industry was probably evolving toward a wider production of cheaper cars, and toward a greater dependence on foreign sources for more expensive cars. This is certainly a step in the direction of more intense industrialization.

The foreign trade in steam engines, machinery, boilers and spare parts of machines, and the manufacture of these products, are, by the nature of things, well rooted in the past industrial and commercial history of France. The movement of imports and exports of manufactured metal goods during the past thirty-two years is shown in the following table:

Year	Foreign Trade in Machines, Boilers and Spare Parts (In thousands of tons)	
	Imports	Exports
1895	52	28
1900	118	43
1905	194	55
1910	174	67
1911	208	76
1912	210	79
1913	221	82
1919	265	54
1920	372	90
1921	291	104
1922	189	83
1923	169	138
1924	163	165
1925	144	177
1926	147	216
1927	111	220

From the industrial revolution on, that is, from the time when modern machinery first came into current industrial use, France always had to look abroad — at the opening of the nineteenth century to England, then to Germany, and then to the United States — for a large proportion of the machines required. In 1924, for the first time, exports exceeded imports in weight; and that was indeed a momentous event, for as the foreign trade statistics of the following three years show, this excess of exports was maintained despite the rise of the franc at the close of the period considered, and even increased from 1926 to 1927. The export figures testify to a definitely enhanced capacity of production on the part of the machine making industries of France, while the shrinking volume of imports clearly reflects the growing adaptation of this production to domestic needs both in quantity and in kind.

Of the various industrial machines which post-war France was beginning to manufacture for herself in increasing quantities, after more than a century of dependence on foreign sources, textile machinery is an outstanding example. When the Germans invaded the north of France they were astounded to find so few factories for the manufacture of textile equipment in the very region where the textile industry was most concentrated.[47] One of the most striking features of the typical French wool-scouring, spinning or weaving mills is the variety of languages in which the trade marks of the machines are written. A very large number are in English, many are in German, and even those in French are sometimes of Belgian firms; and to this babel of trade marks Czech has been added since the war. Before 1914 England, Germany, Switzerland, and Belgium all exported large quantities of textile plant equipment into France:

Country of origin	*French imports of textile machines Annual average 1910-1913 (In tons)*
Great Britain	11,024
Germany	7,373
Switzerland	1,077
Belgium	717
United States	71
Others	324

The Ministry of Commerce estimates that pre-war France imported from foreign countries at least half of her textile machinery.[48]

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[47] *L'Industrie en France occupée* (Ouvrage établi par le grand quartier général allemand en 1916), p. 63.

[48] Ministère du Commerce, *Rapport général sur l'Industrie française*, Vol. I, p. 348.

The dependence on England for these machines dates back to the eighteenth century when the epoch-making English inventions in weaving and spinning machinery set that country far in advance of the rest of the world. Closely following on the English achievements, Alsace, which for many centuries had been a famous textile region, set up important plants for manufacturing requisite machinery of the most modern type then known. Consequently, prior to 1870 France supplied herself with textile equipment partly from abroad, and partly on her own soil, in Alsace.

When, as a result of the Franco-Prussian war, Alsace was separated from France, a few manufacturers of textile machinery to whom the German régime was repugnant, migrated across the Vosges and settled within the diminished French frontiers. Some did not go far, but erected new factories around Lure (Haute-Saône) to be near the cotton spinners and weavers who had also come from Alsace under similar circumstances. Others, for the most part manufacturers of machines for the preparatory textile processes and for wool-scouring, went as far as Lille and Roubaix. The factories for the manufacture of wool-combing and spinning machines remained in Alsace. Thus, after the Franco-Prussian war, France became almost as dependent on Germany as she had formerly been on England. As the Ministry of Commerce reported, about three-quarters of the cotton and wool spinning equipment in France before the war was of English make; most of the knitting looms came from Germany; and although the weaving looms were largely made in France, a great many came from Germany and the United States.[49] German statistics of 1916 indicate that in the occupied territory of northern France more than 20 per cent of the textile machines in working order bore German trade marks.[50]

The return of Alsace to France in 1918 modified the situation in respect of textile machinery. The reannexation brought within French frontiers very important textile-machinery plants in complete working order, and lessened by so much France's dependence on Germany. Thus, instead of constituting 36 per cent in weight of the total textile machinery imports as they did in the 1910–1913 period, German machines formed only 9.5 per cent from 1923 to 1925. Not only did the proportional part coming from Germany diminish, but the total imports from all countries declined below the pre-war level very rapidly after 1923. At the same time exports swelled to about four to eight times their pre-war volume, as is seen in the following table:

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[49] Ministère du Commerce, *op. cit.*, Vol. I, p. 352.

[50] *L'Industrie en France occupée* (Ouvrage établi par le grand quartier général allemand en 1916), pp. 79–162.

Year	Foreign Trade in Textile Machinery (In tons)	
	Imports	Exports
1910	22,232	3,281
1911	20,336	2,598
1912	18,369	2,527
1913	21,406	1,973
1919	17,483	922
1920	47,957	3,386
1921	44,752	6,123
1922	23,346	9,418
1923	20,297	12,377
1924	14,543	10,702
1925	15,738	12,485
1926	13,906	15,251
1927	11,125	19,382

It will be observed that the excess of imports of 18,000 tons (average for 1910–1913) which prevailed before the war was converted in 1926 into an excess of exports, after an uninterrupted decline in imports and a steady growth in exports during the post-war years. This new phenomenon was not, therefore, a mere incident of inflation but part of a fairly long-term trend. Moreover, the increased excess in exports in 1927 confirms the changed situation as definitely acquired. Nevertheless, it should be noted that while exports increased tenfold from 1913 to 1927, imports diminished by barely one-half. This is simply one of the many illustrations which show that, as a country becomes more industrialized in any particular respect, it does not become self-sufficient in an absolute sense, but specializes in given branches of manufacture and thus continues to be dependent on imports particularly from other manufacturing nations, as is clear from the following figures:

Country of origin	*French imports of textile machines* *Annual average 1923–1925* *(In tons)*
Great Britain	9,948
Germany	1,606
Switzerland	2,515
Belgium-Luxemburg	1,617
United States	627
Others	547

The same movement, consisting of a diminution in imports and an expansion in exports until what had always been an excess of imports became in the latter post-war years an excess of exports, was equally characteristic of other large items of foreign trade in mechanical engineering products, such as boilers, spare parts, machine tools, railway freight cars, street cars and locomotives. Agricultural machinery constitutes one of the rare exceptions to this general rule, for imports coming mainly from the United States and Canada increased after the war much more than exports, and this inevitably made for a still larger excess of imports than was the case in 1913. France had been even before the war essentially an exporter of railway passenger cars, and in the post-war years her advantage in this branch of foreign trade grew. Her excess of exports, which amounted to an annual average of 846 tons in 1910–1913, attained 1,742 tons, or nearly double the pre-war figure, in 1924–1927.[51] As regards steel and iron ships, no particular trend is discernible, but it is to be noted that it was only in 1927 that exports exceeded imports for the first time in the post-war years, whereas before the war, for three years in succession (1910, 1911 and 1912) there had been a constant slight excess of exports.

Perhaps a better measure of the development of the French mechanical engineering industry, as seen from the point of view of purchases and sales abroad, is not so much the increasing excess of exports, as the swelling volume of the whole of foreign trade, imports and exports combined. During 1924–1927, French foreign commerce in mechanical engineering products, measured in weight, was nearly twice as great as it had been in 1910–1913. Nor is the large part that French imports play in this traffic a sign of industrial inferiority, for in 1925 when France was fourth among the machinery-importing nations of the world, Great Britain, importing even greater quantities, was third.[52] The more industrialized a nation is, the more intense will be its exchange of manufactured goods with other highly developed nations. To quote Dr. Karl Lange, "The world trade in machinery . . . depends in a much greater degree on the reciprocal interchange of machinery by different producing countries than on exports to countries in process of industrialization. The countries which produce machinery are each others' best customers." [53]

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[51] The annual average for 1924–1927, omitting the year 1926, was 2,229 tons. In 1926 only 557 tons were sold abroad as compared with 2,381 tons in 1925 and 2,165 tons in 1927 — which is additional proof that the acute drop in the franc inhibited rather than encouraged exports even in well established branches of export trade.

Conclusion

The increasing volume of exports of mechanical engineering products is only a partial solution of the fundamental industrial problem with which France is faced: how can she most profitably utilize her vastly increased capacity of producing raw iron and steel which resulted from the reannexation of Lorraine? Obviously the answer is: by developing as far as possible the manufacture of finished iron and steel products. That there is room for such development is seen in the table on page 337, which reveals a lag in the post-war progress of consumption as compared with the growing production of the raw materials of the mechanical engineering industries.

The continued expansion of the mechanical engineering industry, however desirable, is limited by the absorbing capacity of available markets. Although the weight of exports of fabricated metal goods tripled from 1913 to 1926–1927, the proportion disposed of in this way was still small, constituting in 1913 less than

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[52] League of Nations, *Mechanical Engineering*, Vol. I, p. 50.

[53] League of Nations, *op. cit.*, p. 25.

Year	Percentage of 1913 Production in France Not Including Alsace-Lorraine [54]		
	Pig Iron	Raw Steel	Engineering Products (Apparent Consumption of Iron and Steel)
1924 (including Alsace-Lorraine)	148	147	137
1925 " " "	163	158	123
1926 " " "	180	179	144

6 per cent in weight as compared with the apparent consumption of iron and steel by the French mechanical engineering industries: 9 per cent in 1924 and 15.5 per cent in 1926. Even an additional increase like that which took place from 1924 to 1926 — which is hardly probable in the calculable future — would still take care of but a small part of the total amount produced. Obviously the principal market is domestic, and if mechanical engineering production is to keep pace with metallurgical production, it is the home market that must be expanded.

The limitations inherent in French conditions which stand in the way of a probable rise in the French consumption of iron and steel up to the level reached by the United States and Germany, have already been discussed in the preceding chapter. Whatever the attainable maximum may be for the French consumption of all iron and steel products, so far as machinery is concerned there is still a wide margin to be filled, which corresponds, moreover, with the difference between the status of industrialization of France and of other countries.

[54] There is an unavoidable error involved in the computation of the 1925 and 1926 figures because of the inclusion of the Saar in foreign trade statistics of France for those years, but it is extremely improbable that any correction would alter the fundamental difference between the rate of development of engineering production and the production of raw iron and steel. For data, see preceding chapter and p. 306.

Country	Per Capita Consumption of Machinery [55] (In dollars)	
	1913	1925
Great Britain	$5.29	$12.72 (1924)
Switzerland	7.45	12.60
Germany	7.69	8.62
Belgium	5.69	6.00
Netherlands	4.69	5.72 (1924)
Sweden	4.05	4.84
Denmark	3.29	4.12 (1924)
France	2.45	3.45

In view of the fact that post-war gold prices of machinery were between 140 and 150 per cent of their pre-war level,[56] it appears that the per capita consumption of machinery in France was just about the same in 1925 as it had been in 1913.

While the above statistics are at best only rough estimates, yet they reveal great possibilities in the way of a future increased utilization of machinery in France. This will, to be sure, depend upon a number of attendant circumstances, such as the stimulus to machine production which comes from rising wages and a shortage of labor. It will also depend on trade conditions, and on progress in the organization and technique of manufacture in the mechanical engineering and other industries. It is important to note in this connection that among the largest consumers of industrial machinery are the manufacturers of mechanical engineering products themselves, so that any intensification in the consumption of machinery is bound to be cumulative in its effects. It is for this reason that the status of the mechanical engineering industry in the post-war period may be regarded as a measure of the consumption as well as the production capacity of manufactured metal products in France.

The relative rarity of highly concentrated large-scale mechanical engineering plants, their excessive subdivision and dispersion over the territory of France, their want of a cohesive national organization to apportion domestic and foreign markets on a rational basis and to standardize production, all constitute elements of great weakness. Given, however, the fact that most French metal goods firms are old personal enterprises, founded in the days when corporate ownership was rare and exceptional, the lack of concentration and coördination has been almost inevitable. The factories have grown slowly by accretion and have adapted themselves tardily to the technical needs of the day. They have been, in fact, patrimonial heirlooms cherished by their owners who fondly cling to the rule-of-thumb methods of their fathers. Being untouched by financial pressure, because their ancient tangible capital had long been amortized, they have not been in the position of modern large-scale firms which are burdened by fixed interest charges and constantly feel the need of reducing costs of production, increasing the size of the plant, scrapping old machinery and introducing the most recent technique. As long as cost accounting reveals the possibility of selling at a profit, the personal owner lets well enough alone.[57]

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[55] League of Nations, *Mechanical Engineering*, Vol. I, pp. 168–169. Converted from Reichsmarks into dollars at .2382 per R. M.

[56] *Ibid.*, p. 171.

If giant competitive firms were looming up on all sides beyond the national frontiers and threatening to crush the French mechanical engineering business, high tariff rates were considered the proper remedy with which to thwart the danger. This state of mind has been set forth very explicitly by the *Chambre Syndicale des Constructeurs et Fondeurs de l'Est* in 1927 when they maintained that any new tariff revision ought to take into account "the permanent causes of the economic inferiority" of France, and ought to charge from 15 to 18 per cent ad valorem duty on imported engineering products.[58]

It would be erroneous to suppose that the French mechanical engineering industry has made no progress at all either before or since the war. The stimulus has come, however, to a very large extent from abroad. Sometimes foreign mechanical engineering manufacturers have established model branches in France which compete with native firms on their own soil. These influences have forced the French manufacturers to keep pace, to a certain extent, with the advance realized elsewhere, but, on the whole, the business and technical organization of the mechanical engineering industry in France is still sluggishly trailing behind that of England, Switzerland and Germany — not to speak of the United States — in efficiency. Such a situation is, of course, remediable. Nevertheless, besides the mere lack of will to progress, there are other more formidable and more material impediments in the way of indefinite expansion and amelioration. Most important among these obstacles is the limited supply of coal in France. The solution of this difficulty lies, as has previously been observed, in an economic *entente* with Germany permitting France to import adequate quantities of Ruhr coal. Otherwise France may indeed be forced to resign herself to meditate on "the permanent causes of the economic inferiority" of her mechanical engineering industry.

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[57] After the war the corporate form of enterprise was widely adopted even by old firms, but this was only a device to escape certain taxes; corporations thus floated were strictly private.

[58] *Journée Industrielle,* March 19, 1927, p. 3.

CHAPTER XIII

TEXTILES I:

THE GENERAL SITUATION AND COTTON

From many points of view French textile manufactures, taken as a whole, may be considered as the principal industry of the country. According to the 1906 census, 913,989 persons were gainfully occupied in preparing, spinning and weaving textile materials. If to these are added the 1,551,131 persons in the clothing industry at that time, it is found that nearly two and a half million persons were engaged either as employers, wage earners, or isolated workers, in the elaboration of textiles at one stage of manufacture or another. They represented in 1906 about 36 per cent of the total industrial population,[1] while the metallurgical and engineering trades taken together absorbed not quite 12 per cent.

According to statistics taken in 1913,[2] the total number of steam-generated kilowatts in France amounted to 2,467,000, of which 498,000 were utilized in metallurgical works, 495,000 for the production of electric current, 356,000 for mines and quarries, and 331,000 for textile and clothing plants. If one stops to consider that hardly less mechanical energy was consumed for spinning delicate textile fibers, weaving gossamer threads and sewing fabrics than for raising millions of tons of ponderous ore and coal from deep mines, and removing massive rocks from nature's tight grasp, the significance of the above figures becomes more striking.

The census of 1921, which gives the only available figures of the industrial population of France since the war, confirms the textile and clothing manufactures in their rank as the most important industrial group in France from the point of view of the number of persons actively engaged. When, however, these figures are compared with those of 1906, or with earlier statistics, a very sharp decline is noted, both absolutely and relatively:

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[1] In 1906 there were 7,224,873 persons actively engaged in the extractive, transformation, transport and state industries.

[2] *Annuaire Statistique, 1926*, p. 66.

Year of Census	Number of Persons Gainfully Occupied in Textile and Clothing Industries	Ratio to Total Industrial Population
1896	2,204,948	35%
1901	2,275,142	34
1906	2,465,120	34
1921 (1914 area)	1,917,113	26
1921 (including Alsace-Lorraine)	2,007,714	26

In view of the fact that these statistics include the unemployed as well as the employed, it would not be exact to attribute the sharp drop to the industrial depression of 1921, when the textile industry functioned at only 52 per cent of its pre-war capacity.[3] Nor does the devastation of the north explain anything but a part of this decline of 23.5 per cent. If only the 77 départements which remained outside of the war zone be considered, the diminution is still of the measure of 21 per cent. There can be no doubt that the real cause lies in the rapid mechanization of the manufacturing processes. In fact, the average number of watts of steam energy generated in textile and clothing plants per person engaged was 134 in 1906 and 205 in 1921. This is most likely an underestimate of the progress really accomplished, for it does not take into account all the mechanical energy utilized by textile mills. In the post-war years textile mills bought more and more of their electric current from central stations instead of generating it themselves. At any rate, the decline which industrial population statistics show is not to be construed as indicating any diminution in the relative importance of the textile and clothing industries.

1. The Raw Textile Situation

The life-blood of any industry is its raw material. The question may be raised: How rich is France in raw textiles?

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[3] Dessirier, *Bulletin de la Statistique Générale de la France*, April 1926, p. 305.

Raw Cotton

More than a century ago, when the cotton industry was still in its infancy, and when cotton was rarer and more fashionable than silk is to-day, Napoleon cherished the ambition of making France self-sufficient, even to the point of endeavoring to raise raw cotton within the country. His military genius was unavailing, however, in the face of natural obstacles, such as unsuitable climate and soil. France has always been, and still is, dependent on imports for 100 per cent of its raw cotton. The average net imports into France during the four years that preceded the war were 235,731 metric tons.[4] If 30 per cent be added to represent roughly the amount of cotton the mills of Alsace-Lorraine probably absorbed[5] at that time, a figure is reached which is comparable with the post-war development:

Year	*Net imports of raw cotton in France (In metric tons)*
1910–13 (average, including Alsace-Lorraine)	306,452
1919	218,547
1920	234,927
1921	211,527
1922	263,788
1923	261,529
1924	301,975
1925	340,243
1926	368,244
1927	355,723[a]

[a] Provisional figures.

After the war, as the above table indicates, net imports of raw cotton did not attain their pre-war level until 1925, and it is to be noted that in this year and in 1926 the pre-war figure was surpassed by 11 per cent and 20 per cent respectively. Since these net imports constitute the amount of raw cotton eventually consumed by French industry, their movement is of significance as a measure not only of foreign trade, but of industrial activity as well. The fluctuations noted above are not unlike those found in many other industries of France, and they serve to illustrate the general rate of recuperation of French production after the passing of the destructive wave of war.

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[4] Including linters.

[5] The pre-war cotton-spinning capacity of Alsace-Lorraine is estimated at 27 per cent. Thomas, "Les Textiles," *Revue d'Économie Politique*, Nov.–Dec. 1924, p. 1029.

Raw Wool

Nature was in a much more generous mood when it endowed France with climate and soil conditions for raising wool. The manufacturers of finer woolen fabrics frequently obtain their raw material from the sheep flocks of Berry, Chartrain, Beauce, Île de France, Soissonnais, Sarsac, Provence, Roussillon — to name only a few of the regions of France where sheep are raised. Rarely does the American sheep-raiser go through France without visiting the flocks of pure-bred Rambouillet sheep, the wool of which has been world-famed for centuries. And yet, in spite of the growing demand of the rapidly expanding wool industry, the French stock of sheep, which in 1852 amounted to over 33 million head, declined to less than half that number on the eve of the war and consisted in 1926 of about eleven million head.

What had happened? Certainly natural conditions of soil and climate did not change. Man, however, did change in his social and economic life. The increase in population during the first half of the nineteenth century brought about a parcelling of farm property which was unfavorable to animals such as sheep which need large spaces over which to graze. This same cause, with its inevitable accompaniment, the growth of cities, made intensive truck farming more profitable than any kind of extensive cultivation. Pasture lands were sacrificed. The new, rich, thickly populated industrial communities wanted meat, and so sheep were raised for mutton rather than for wool. Furthermore, extensive sheep raising requires shepherds, but the pleasures of industrial community life lured young men away from lonely plains and hillsides. France now suffers from a dearth of shepherds. To cap it all, as the second half of the nineteenth century wore on, and shipping in steel hulls became a perfected art, home wool-raising suffered from competition with the overseas sheep ranches of the Australian plains and the South American pampas. The result of all this has been that France, like the other countries of Western Europe, became irretrievably dependent upon imports from distant lands for the raw material of one of the oldest branches of the textile industry.

Bales of new wool, as they come to the unloading platform in front of carding and spinning mills, almost always contain more dirt and animal grease than wool. The proportion of wool to foreign matter varies with the country of origin. Wool from sheep living on the open plains of South America contains much less offscouring than the wool from French sheep which lie about in stables. By applying yield coefficients published by the experts of the *Commission Permanente des Valeurs de Douane*, it is possible to reduce the raw wool of divers origins to comparable washed wool figures. During the four years preceding the war, the average annual shearings in France amounted to 13,845 metric tons of wool when washed. During those same years, France imported annually 100,573 tons on the average. In other words, 87 per cent of the washed wool required by French industry came from abroad. The relation of these figures to the post-war supply of washed wool and the proportion imported can be seen in the following table:

YEAR	NET IMPORTS AND DOMESTIC SHEARINGS, IN TERMS OF WASHED WOOL (In tons)	PERCENTAGE IMPORTED
1910–1913 (average)	105,001	87
1919	78,116	88
1920	73,549	87
1921	68,437	86
1922	132,965	93
1923	113,539	93
1924	98,681	90
1925	104,627	91
1926	113,382 [a]	91 [a]

[a] Provisional figures.

While France was becoming increasingly dependent on outside sources for raw wool as the needs of industry expanded, at the same time she achieved a position of relative commercial autonomy in raw wool purchases. About forty years before the war, all overseas wool destined for Europe came first to London, which was, so to speak, sole agent for the sale of this product to the Continent. The burden of commissions and reshipment charges weighed heavily on the French wool industry. Gradually the merchants and manufacturers of the Roubaix-Tourcoing region fought their way to independence of the London wool exchange, by sending purchasing agents directly to Australia, Argentina, Uruguay, etc.[6]

YEAR	PERCENTAGE OF TOTAL WOOL IMPORTS[7]		
	Imports from Australia	Imports from South America	Imports from Australia and South America combined
1910–1913 (average)	32%	36%	68%
1919	4	38	42
1920	22	31	53
1921	36	30	66
1922	39	33	72
1923	45	23	68
1924	41	21	62
1925	40	23	63
1926	40	22	62

This growing commercial independence is regarded by some French writers as of precarious tenure. They look with dismay upon the development of the Pan-American idea, for they fear that it may eventually find expression in an all-American customs union which would reserve all of the La Plata wool for American industry.[8] These writers are no less appalled by the talk of a British Imperial customs union which may deprive France of Australian wool. One need but glance at the table of percentages of wool coming from South America and Australia (see page 346) to perceive how heavily France leans on these two particular sources. What is true of France, however, holds equally for all other continental European countries. It would appear, therefore, that M. de Rousier's apprehension lest the British Empire and Pan-America hold all Europe in a state of abject economic servitude seems somewhat exaggerated.

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[6] J. F. Butler, *A Survey of the French Wool Industry* (U. S. Department of Commerce, Special Bulletin, No. 412); and F. Maurette, *Les Grands Marchés des Matières premières*, p. 86.

[7] Calculated from imports of raw wool, in the grease, shorn and pulled, and wool wastes.

Raw Silk

The beginnings of the silk industry in France are hidden in a veil of legend.[9] In the course of the thirteenth century, the art of breeding silk worms was introduced into southern France through Spain or through the Kingdom of Naples. Up to the close of the sixteenth century, however, all efforts in this direction were sporadic and feeble. The picturesque Henry IV, following the suggestions of his advisors, Laffemas and Olivier de Serres, gave the first impetus to systematic breeding. By a curious coincidence, just about this time, the Manchu dynasty, notoriously hostile to foreign commerce, came into power in China. The resulting difficulty of obtaining silk from the Orient made home production all the more important from that time. With the advent of the nineteenth century, when on all sides industrial and agricultural production burst out of its traditional small-scale framework, silk-worm raising followed the general trend and grew with remarkable rapidity until 1853. After that year, as the sharp decline in the following table indicates, a terrible catastrophe befell the industry. The pebrine epidemic attacked the delicate worms in their overcrowded nurseries, and in less than ten years French domestic production of raw silk fell from over 2 million kilograms to less than 500,000 kilograms:

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[8] De Rousiers, *Les Grandes Industries modernes*, Vol. III, p. 189.

[9] Louis Gueneau, *Lyon et le Commerce de la Soie*, pp. 41–48.

Year	French Production of Raw Silk[10] (In metric tons)	Year	French Production of Raw Silk[10] (In metric tons)
1805	350	1895	775
1812	420	1900	725
1822	900	1905	325
1833	960	1910	320
1843	1,520	1911	402
1850	2,100	1912	505
1853	2,160	1913	350
1855	1,850	1918	245
1860	650	1919	180
1865	350	1920	250
1870	660	1921	195
1875	725	1922	198
1878	875	1923	255
1880	520	1924	335
1885	550	1925	260
1890	660	1926	240

Thanks to Pasteur's researches into the cause and remedy of the pebrine disease, a marked recovery can be observed after 1865, but by that time the British guns had opened China's doors and the peaceful intervention of the American navy in Japan brought that country into commercial relations with the Occident. The inauguration of the Suez Canal in 1869 cut the commercial distance between the Occident and Orient in half. All these circumstances led to a revival of the raw silk industry in the Far East at the expense of European production, which was struggling to get back on its feet again, after the epidemic. The following curve of the world production of raw silk during the last half century (Chart XXIII) indicates to what an infinitesimal rôle French production has been reduced in recent years.[11]

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[10] For the years 1805 to 1905, these figures were derived from a curve published by Pierre Clerget, *Les Industries de la Soie en France*, p. 11; the figures for 1910 to 1922 from the Commission Permanente des Valeurs de Douane; and those from 1923 to 1926 from the Reports of the Syndicat des Fabricants de Soieries de Lyon.

[11] For data see *Annuaire Statistique, 1926*, p. 305, and the 1927 Report of the Syndicat des Fabricants des Soieries de Lyon (for 1926 figures).

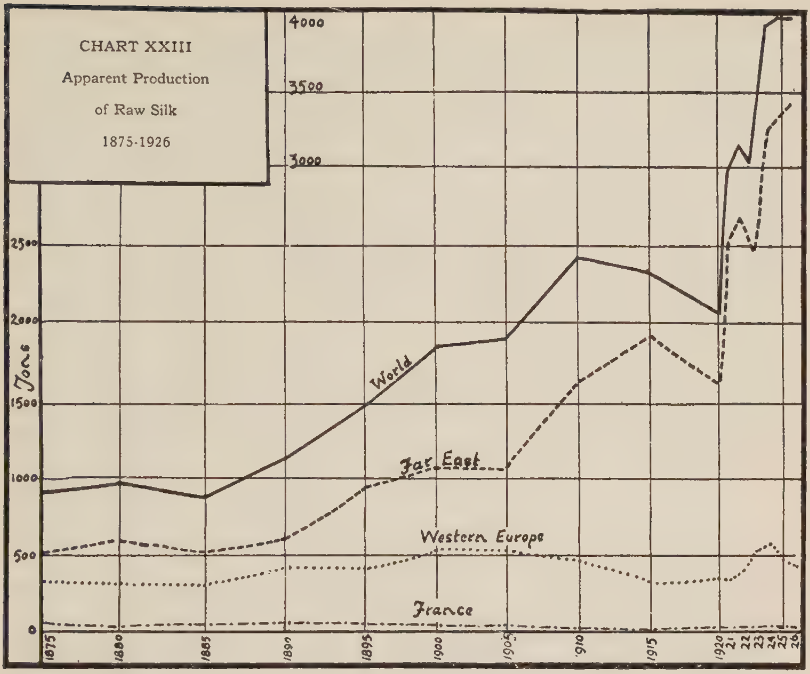

CHART XXIII

Apparent Production of Raw Silk

1875-1926

From the point of view of natural conditions, France is no less admirably suited for silk-worm raising than for wool-raising. In fact, the greater part of France lies within the silk-worm belt, which is between 25° and 48° North Latitude. Here the climate is most favorable, not only for the worms, but for the mulberry trees on the leaves of which the worms feed. Nevertheless, historical circumstances and social changes conspired against any expansion of this branch of production. The factory, imposing only carefully defined and subdivided tasks, and granting complete freedom from responsibility once the whistle has blown at the end of the day, proved more attractive to young French workingwomen than silk-worm nurseries which require infinite care and devotion, even to the point of feeding meticulously cleaned and chopped mulberry leaves to the worms several times during the night at certain seasons. In the post-war period the closely knit, well disciplined family units, best adapted for this sort of work, were fast disappearing in France. When it is remembered that any labor hired for this purpose in France must in final analysis compete with Chinese and Japanese family labor in the creation of the same product for the same market, it becomes immediately evident that wages were necessarily far from seductive. As a consequence France was obliged to import from abroad an ever increasing proportion of the silk needed for her industry:

Year	Net Imports and Domestic Production of Raw Silk in France[12]	Percentage Imported
1910–1913 (average)	4,268	90.8
1919	4,670	96.1
1920	3,749	93.3
1921	2,585	92.5
1922	4,873	95.9
1923	3,453	92.6
1924	5,912	94.3
1925	5,212	95.5
1926	6,640	96.4

Raw Textile Imports and the Balance of the Textile Trade

What was true of the raw materials utilized for the three principal textiles, cotton, wool and silk, was no less true of the lesser textiles such as hemp, jute, and China grass. Only flax was produced in France in sufficient quantity to supply domestic needs and leave a surplus for exportation as well.

Obviously the purchases abroad of immense quantities of raw textiles resulted in a heavy drain on French financial resources. Even before the war France, on the average for the years 1910 to 1913,[13] imported 1,767,000,000 francs' worth of textile fibers, and exported 660,000,000 francs' worth. This left an average unfavorable balance of 1,107,000,000 francs per year, which had to be covered by the purchase of foreign moneys to pay the Australians for their wool, the Americans for their cotton, the Chinese for their silk, etc. When the franc was at par, before the war, the unfavorable balance in the raw textile trade did not matter, for the purchases of foreign currency by textile fiber importers were more than compensated by sales of the franc to foreign importers of French goods and to foreign borrowers of French capital paying interest and other charges to France. In the post-war period, however, with the foreign exchange rate of the franc at the mercy of an international speculative market, and with the general balance of accounts in a state of constant uncertainty, because of the large part played by unconsolidated government debts, an unfavorable balance in any branch of international commerce was often regarded as little short of a national calamity. The table below indicates that the burden of the unfavorable balance in the raw textile trade increased considerably after the war, even when the post-war francs are estimated in terms of gold francs:

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[12] Calculated according to the method of the Commission Permanente des Valeurs de Douane.

[13] Raw cotton, wool, silk, flax, jute, hemp, phormium tenax, and ramie.

EXCESS OF IMPORTS OVER EXPORTS IN THE TEXTILE FIBER TRADE

Year	In Millions of Paper Francs	In Millions of Gold Francs [14]
1910–1913 (average)	1,107	1,107
1919	4,145	2,946
1920	6,059	2,170
1921	2,070	809
1922	3,772	1,587
1923	5,591	1,747
1924	7,377	1,978
1925	8,399	2,050
1926	11,446	1,889
1927	9,285	1,887

Balances like the above are found more often than not in French foreign-trade statistics of raw and partly prepared materials necessary for industry. Their disastrous repercussions on the fluctuations of the franc have led certain French writers to advocate a policy of self-sufficiency behind impenetrable tariff walls.[15] France, they say, is so richly endowed with a great variety of natural resources that she ought to be practically independent. Certain elements of truth give this argument plausibility. It is, for example, physically possible for France to raise much more raw wool and silk than she is raising. But it is not socially possible. Historical and human factors are no less important in industrial enterprise than natural factors.

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[14] Estimated by dividing paper francs by the annual average dollar exchange rates.

[15] Jerzy Nowak, *L'Idée de l'Autarchie économique*, pp. 133–138.

If, in order to avoid buying foreign currency, frontiers were closed to raw textiles from abroad, at least one-quarter of the workers engaged in industry, properly speaking, would be jobless and one-sixth of the steam-generated horse power for all French industry (except electric power plants) would be idle, not to mention the disastrous effect on related industries. With a complete absence of cotton, and with other textile fibers reduced to a few per cent of the normal supply, the consumer's situation would be impossible.

What about the colonies? Has not France a colonial empire more than twenty-six times her own area? Is it not almost as far flung as the British Colonial Empire? Are there not French colonies in Africa, Asia, America and Oceania — with varying climates, soils and natural resources? Why not, then, create an economically self-sufficient French empire, independent of foreign markets?

The attractive feature of such a speculative question is the impossibility of giving categorically negative replies. Nevertheless, remote possibilities have no practical value, for if one asks how much raw cotton or raw silk was imported into France from her colonies, the answer is given in the following table:

Year	*Ratio of raw cotton coming from the colonies to total net imports*	*Ratio of raw silk coming from Indo-China to total net imports* [16]
1910–1913 (average)	.23%	.41%
1919	.82	
1920	1.28	.61
1921	.88	.49
1922	1.06	.39
1923	.87	.56
1924	.92	.44
1925	.92	.36

[16] The quantities imported from other colonies were negligible.

All the post-war efforts of France to develop cotton or silk growing in the colonies did not avail her on the average even one per cent of the amount required. It is clear that the development of whatever potentialities there may be in French Africa and French Indo-China is the work of many decades to come.

The post-war increase in the supply of colonial wool was more encouraging, according to the table below:

Year	*Ratio of raw wool coming from the colonies to total net imports*[17]
1910–1913 (average)	4.6
1920	6.33
1921	6.26
1922	3.61
1923	6.28
1924	7.88
1925	6.62

Still the bulk of raw wool consumed by French industry continued to come from Australia and La Plata. In view of the fact that colonial wool is of the cross-bred variety unsuited for finer quality fabrics, one may venture to guess that colonial wool must play a subordinate part for a long time to come.

Those who seek to liberate France from the tribute paid to foreign lands for her raw textiles propose still another remedy. They advocate the development of the artificial textile industry. Artificial wool is still in its infancy, but the manufacture of artificial silk, or rayon, is growing in France by leaps and bounds. In contrast with natural silk, for the supply of which France depends almost exclusively on imports, domestic production of rayon may be said to have yielded, in 1926, 100 per cent of the quantity needed for French industry, since exports and imports were approximately equal for that year.

Although the first successful process of producing artificial silk on a commercial scale had been invented in 1885 by a Frenchman, Count Hilaire de Chardonnet, France up to very recent years was very slow to accept rayon. The natural silk manufacturers were hostile to the new industry, because they feared competition. After 1922, however, they became reconciled to artificial silk and even invested large sums in rayon plants when they realized that the increased use of the new fiber did not result in any diminution in the market demand for natural silk.[18] The economic classes that had been used to wearing the costly natural silk in the past continued to do so. Rayon was found to be consumed largely by persons who had practically never used real silk. Furthermore, rayon was used in enormous quantities for mixtures in wool, cotton and natural silk fabrics in order to give special effects in the dyeing and finishing process. Even if France succeeds in manufacturing at home all the artificial silk she requires, it does not seem likely to lead to any diminution in imports of other textile fibers.

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[17] This includes wool in the grease, shorn and pulled, and the wool on the backs of imported live sheep, of which large numbers came from Algeria.

An additional reason why the expansion of the rayon industry did not bring about a reduction of the import requirements of France is that the principal raw materials for artificial silk came exclusively from abroad. With few exceptions French rayon is manufactured by what is known as the viscose process, for which the principal raw material is bleached sulphite wood pulp. M. Carnot, president of the *Syndicat des Textiles Artificiels*, has pointed out that ". . . viscose silk demands a special wood pulp which it has not been possible to produce as yet with products of the French soil."[19] Imports of wood pulp, employed in the paper as well as in the rayon industry, exceeded exports in 1926 by over 661 million paper francs (approximately equivalent to 109 million gold francs). Certainly France is just as dependent on foreign sources for the basic raw materials of its rayon industry as for that of its cotton industry.

The short-sightedness of the advocates of economic self-sufficiency becomes even more evident when one turns from the unfavorable balance in the trade figures of raw textiles to the favorable balance in the trade statistics of manufactured textiles exclusive of clothing:

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[18] E. T. Pickard, *Commerce Report*, American Embassy in Paris, March 8, 1926.

[19] *Chimie et Industrie*, p. 1407.

EXCESS OF EXPORTS OVER IMPORTS IN THE PURCHASE AND SALE OF YARNS AND FABRICS ABROAD[20]

Year	Millions of Paper Francs	Millions of Gold Francs
1910–1913 (average)	864	864
1920	2,397	858
1921	3,539	1,383
1922	3,867	1,626
1923	4,978	1,556
1924	8,863	2,376
1925	9,100	2,220
1926	11,214	1,850
1927	11,472	2,332

If the unfavorable balance resulting from the raw textile trade[21] is subtracted from the above favorable balance, the following significant results are obtained:

BALANCE OF TRADE IN RAW AND MANUFACTURED TEXTILES

Year	Millions of Paper Francs	Millions of Gold Francs
1910–1913 (average)	−243	−243
1920	−3,662	−1,312
1921	+1,469	+574
1922	+95	+39
1923	−613	−191
1924	+1,486	+398
1925	+701	+170
1926	−232	−39
1927	+2,187	+445

The minus signs indicate that before the war and immediately after the war, more francs' worth of raw and manufactured textiles were imported than exported. Up to 1921, consequently, the francs exchanged for foreign currencies to cover the excess of imports in textiles tended to increase the supply of francs on the international money market and to lower the value of the franc. As the textile industry recovered its strength in the north, and as foreign trade, stimulated by lower costs of production in France, expanded in volume, the tables were turned and exports exceeded imports. So far as textiles were concerned, more francs were bought up by foreign buyers to pay for their purchases in France than French textile traders had to offer in order to obtain what they wanted abroad. This was true for all the years after 1921 with the exception of 1923, when the invasion of the Ruhr disorganized completely Franco-German commercial relations. It will be observed that again in 1926 a slightly unfavorable balance reappeared, but this was only a passing phenomenon, as the record favorable balance of the following year indicates. The acute inflation of the currency in 1926 exercised a disturbing rather than a stimulating influence on foreign trade in textiles.

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[20] This table is made up of the following items: wool, silk, cotton, linen, hemp, ramie jute and phormium tenax yarns and fabrics.

[21] *Cf. supra*, p. 351.

2. The Cotton Industry

On the eve of the war France had attained a high standing among cotton-manufacturing countries. The 7,400,000 French spinning spindles[22] for raw cotton in 1913 represented 5.2 per cent of the estimated world total, and in this respect France held fifth place, following Great Britain (38.8 per cent), the United States (22 per cent), Germany (7.8 per cent), and Russia (5.2 per cent). In the course of the year from September 1, 1912 to August 31, 1913, French cotton mills consumed 1,010,000 bales of raw cotton, that is, 4.4 per cent of the estimated total world consumption.[23] France was fourth consumer of cotton in Europe, coming after Great Britain (18.7 per cent), Russia (9.2 per cent) and Germany (7.4 per cent). Furthermore, as an exporter of cotton piece goods, France in 1913 was outranked only by Great Britain and Italy among European countries.

It is important to observe, however, that before the war many

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[22] Exclusive of doubling and waste spindles. Source: League of Nations, *Memorandum on Cotton*, pp. 7–8.

[23] *Ibid.*, pp. 59–61.

French cotton mills were very backward in their manufacturing technique and commercial organization.[24]

Modern large-scale plants, each employing several hundred and sometimes several thousand workers, were relatively rare in France. More common were the small cotton-spinning and weaving mills of less than a hundred employes each. In England and Germany the average number of spindles per mill was more than twice that of French mills.[25] While in the United States and in England as many as twelve and fourteen weaving looms could be operated by a single person, in France the number of cotton looms per worker was ordinarily three or four.[26] Instead of highly specialized plants such as are found in Lancashire (England), where whole groups of large factories produce only a small number of counts[27] (standard thicknesses) of cotton yarn, the French had many small spinning mills which manufactured the whole gamut of yarns from the finest to the coarsest. They thus involved themselves in useless expenses and were placed at a competitive disadvantage. Their costs of production were maintained at a relatively high level because of the great variety of preparatory and other machinery which was frequently idle when given counts were not in demand.

These are the disadvantages that frequently come with an early start in any industry. There is a strong reluctance to scrap completely old-fashioned machinery, when patching will do — unless competition forces the mill owner's hand. Nevertheless, manufacturing went on in France, even for exportation, with antiquated machinery and methods, because tariff measures and administrative devices reserved for French loom products a considerable colonial market.[28]

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[24] Albert Aftalion, *L'Industrie textile en France pendant la Guerre*, pp. 93–94.

[25] Pierre Grillet, "L'Industrie du Coton," *Enquête sur la Production française*, edited by Hauser and Hitier for the Association Nationale d'Expansion Économique, pp. 161–162. Professor Aftalion, *op. cit.*, p. 96, citing Forrester's *The Cotton Industry in France*, p. 47, gives the following figures for the average number of spindles per establishment: 67,000 at Lille, 36,000 at Roubaix-Tourcoing, 38,000 in the east of France, 24,500 in Normandy, 23,000 in the rest of France.

[26] Grillet, *op. cit.*, p. 160.

[27] The higher the count, the finer the thread, for the count represents a given length per fixed standard of weight.

[28] Aftalion, *op. cit.*, p. 94.

One of the most important events affecting in a permanent way the post-war cotton situation of France was the reannexation of Alsace-Lorraine. According to the estimates made by the Ministry of Commerce, the three recovered départements contributed 25 per cent to the pre-war number of cotton spindles in France, 33 per cent to the cotton looms and 123 per cent to the calico printing machines.[29] These figures agree substantially with those of M. Thomas of Mulhouse, who was in constant touch with the textile situation of the region.[30] The proportional increase may seem astonishing in view of the fact that the population of Lorraine in 1921 was only 4.4 per cent of the total population of France. The environs of Mulhouse and Colmar and the whole valley of the Vosges Mountains had been famous for their textile manufactures for centuries.[31] The importance of this region with respect to cotton and wool is wholly comparable to that of Alsace-Lorraine with regard to steel. It was, moreover, from Alsace-Lorraine that hundreds of mill owners and thousands of workers emigrated after the war of 1870, for patriotic and commercial reasons, carrying with them innumerable textile machines, in order to settle in what was then the new east of France, on the western slope of the Vosges Mountains. The district around Épinal and St.-Dié then became the most active cotton-spinning center of France.

Another event appreciably affecting the course of cotton production was the legacy of destruction which the French cotton industry in the north found on its hands in the years immediately following the recent war. According to the statistics communicated by the *Syndicat Général de l'Industrie Cotonnière*, out of 140,000 cotton looms existing in France before the war, 26,500 had been destroyed or damaged in the course of the war. The rate of reconstruction was in reality very rapid. By the end of 1924 only 2500 looms remained to be put into working order, and at the close of 1925 this number was reduced to 1000. From 1926 on the *Syndicat* ceased taking them into account, because many of the destroyed looms were, even before the war, quite out-of-date or belonged to old mills which probably ought, in any case, to have been scrapped long ago. No less rapid was the reconstruction of destroyed spindles. The following table speaks eloquently for the remarkable speed and energy with which the war-crippled cotton spinning industry of the north was restored:

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[29] Ministère du Commerce, *Rapport général sur l'Industrie française*, Tome I, p. 606.

[30] Thomas, "Les Textiles," *Revue d'Économie Politique*, Nov.–Dec. 1924, p. 1029.

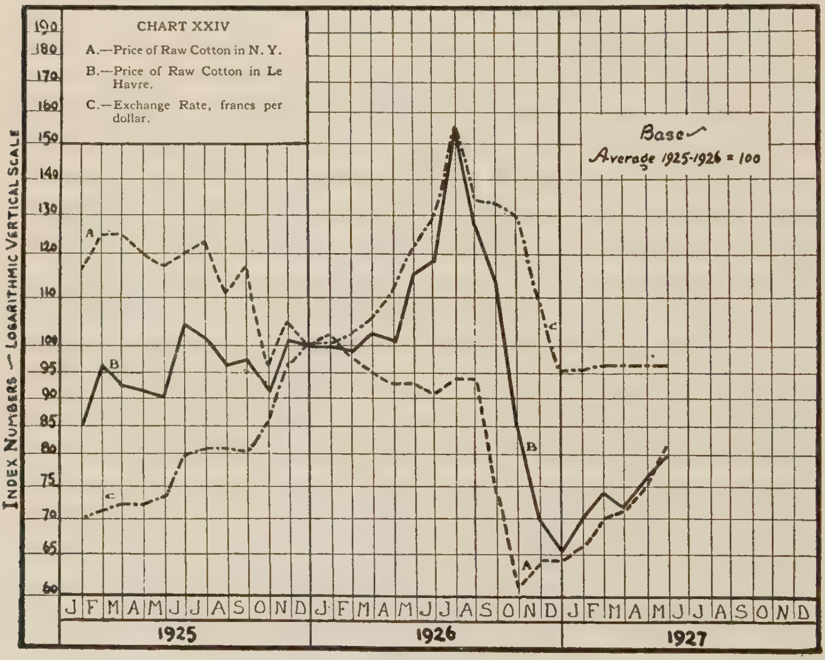
[31] Robert Levy, *L'Histoire économique de l'Industrie cotonnière en Alsace*, pp. 3–6.

Date of Census	Number of War-Damaged Spinning Spindles Not Yet Restored at Date of Census	Ratio of War-Damaged Spinning Spindles to Total Spinning Spindles in Working Order (Including Alsace-Lorraine)
Jan. 31, 1921	1,118,538	13.2%
" " 1922	550,000	6.1
" " 1923	346,500	3.6
" " 1924	222,000	2.3
" " 1925	185,000	1.9
" " 1926	143,000	1.5
" " 1927	90,000	.9

From the point of view of a long-run trend in industrial progress, France benefited to a slight extent by the devastation. The war discarded some plant equipment which had remained in use simply because the owners did not have the business audacity to scrap it. One of the most prominent manufacturers in the north complained to the writer because the war had partly damaged and not completely destroyed his spindles. His reconstruction compensation allowed only for the copper parts which had been removed by the Germans. He envied other manufacturers whose spindles and looms had been wrecked beyond repair, and who received compensation for new machines.

This is probably the reason why the cotton mills of France were far from presenting, after the war, an aspect of complete renovation. The damage was partial, and consequently the reconstruction could only be partial. There was, therefore, no marked break with pre-war conditions as to either technical equipment or general organization of the industry. Much of the inferiority and backwardness which had characterized French cotton manufacturing before the war, still subsisted. Eight years after the war the average number of operatives per thousand spindles in France was as much as 7,[32] while in Oldham, England, as far back as 1895, the average was 2.4 workers per thousand spindles.[33]

The post-war cotton industry was affected not only by the war and the provisions of the treaty of peace, but by the repercussions of the economic changes during the post-war period itself. The most spectacular of these events was, of course, monetary inflation. No less important, from the point of view of the French cotton industry, were the fluctuations in the value of raw cotton on the international market. The accompanying curves (Chart XXIV) [34] show the price of raw cotton in Le Havre (curve B) to be fairly stationary from January 1925 to April 1926, because the pull upwards resulting from the rising price of the franc in foreign currency



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[32] Report of the 1926 General Assembly of the Syndicat Général de l'Industrie Cotonnière Française, p. 67.

[33] De Rousiers, *op. cit.*, p. 83.

[34] For data see *Bulletin de la Statistique Générale de la France.*

(curve C) is neutralized by the downward pull resulting from the steady decline in the price of cotton in New York (curve A). From April to August 1926, while the New York prices remained practically stationary, the Havre quotations were at the mercy of fluctuations in the foreign exchange rates of the franc. After August 1926, up to the close of that year, a precipitate fall in the price of raw cotton, measured in francs at Le Havre, is noted. There were, during this period, two downward forces acting simultaneously: the first, a rapid decline in the number of francs per dollar; and the second, a marked drop in the price of cotton in New York. During the first five months of 1927, when the foreign exchange rate remained stable, the price of cotton in Le Havre varied, as would be expected, directly with the New York cotton quotations, which, in turn, were affected by crop conditions, floods, the general world market, etc. In view of the fact that most of the cotton fabric manufactured in France was consumed in the country and consequently paid for in francs, and that the prices of raw cotton constituted no less than 75 per cent of the cost of production of cotton yarn,[35] the effects of these varied international financial, trade and climatic conditions on the French cotton industry must have been very considerable.

Production and Domestic Consumption of Manufactured Cotton

The outstanding feature of the cotton industry since the war is the fact that it had not, up to the year 1927, recovered its pre-war level of activity. According to calculations described in the footnote,[36] the estimated production of cotton yarn and of cotton fabric varied from year to year as follows:

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[35] Manoy, "L'Industrie cotonnière," *Revue Syndicale de Documentation Économique*, March 1927, p. 115.

[36] The 1913 production estimate of the French cotton-spinning industry was communicated by Syndicat Général de l'Industrie Cotonnière Française as 243,000 metric tons. In order to render this figure comparable with post-war estimates, it was increased by 25 per cent, representing the ratio of spindles in Alsace-Lorraine to those in France before the war. The total estimated production for France and Alsace-Lorraine in 1913 was thus 303,750 metric tons. No estimates of the annual post-war production of cotton yarn exist. The *Bulletin de la Statistique Générale de la France* publishes regularly, however, the average production per spinning spindle per month in kilo-

YEAR	ESTIMATED PRODUCTION OF COTTON YARN (In metric tons)	PERCENTAGE OF 1913 PRODUCTION
1913 (including Alsace-Lorraine)	303,750	100
1921 “ “ “	152,603	50
1922 “ “ “	213,383	70
1923 “ “ “	218,884	72
1924 “ “ “	215,505	71
1925 “ “ “	224,971	74
1926 “ “ “	229,815	76

YEAR	ESTIMATED PRODUCTION OF COTTON FABRICS [37] (In metric tons)	PERCENTAGE OF 1913 PRODUCTION
1913 (including Alsace-Lorraine)	248,267	100
1921 “ “ “	98,864	40
1922 “ “ “	127,320	51
1923 “ “ “	137,556	56
1924 “ “ “	143,722	58
1925 “ “ “	152,218	62
1926 “ “ “	157,167	63

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grams, according to reports received by the above-mentioned cotton syndicate from factories representing between 50 and 60 per cent of the total number of spindles in France. The same source indicates monthly what proportion of the spindles reporting was idle and what proportion active. For purposes of the calculation under discussion this ratio was considered as true of the entire cotton-spinning industry of France. Furthermore, the syndicate publishes each year in its *Annuaire* the result of an annual spindle census which it takes every January 31, thus giving the total number of spindles in France. In view of the fact that the increase in the number of spindles took place gradually, each census figure was regarded as indicating the total number of spindles in France six months before and six months after the date of the census. With this data an estimate of the production of cotton yarn each month was calculated as follows: total number of spindles in France × percentage of spindles reported each month as active × monthly average production per spindle. The annual figures were obtained by adding the estimates of the twelve calendar months of each year.

[37] Woven fabrics only, exclusive of other cotton manufactures beyond the yarn stage such as laces, embroideries, ribbons, knitted goods, etc., hereafter designated as

Any analysis of the reasons for the slackening of cotton production in France since the war must necessarily be incomplete because of the infinite number and the complexity of the factors involved. It is interesting, nevertheless, to touch upon some of the main causes of this striking diminution in production, because such a discussion points to the influence which the varied economic currents of the post-war period would exert on a particular industry in a given country.

One of the circumstances which undoubtedly affected post-war cotton production in France was the devastation of industrial plants

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cotton articles. There is no way of estimating the production of cotton articles. The Syndicat Général de l'Industrie Cotonnière Française communicated their estimate of the annual production of the French cotton-weaving industry in 1913 as 13,300,000 pieces of 100 metres each. This figure was increased by 33 per cent to 17,733,333 pieces in order to include for comparative purposes the production of Alsace-Lorraine, where the number of looms on the eve of the war was about one-third the number in France. By utilizing the evaluation communicated by the cotton syndicate with respect to the average weight per piece of cotton fabric 100 metres in length (14 kilograms) the estimated 1913 production in weight of cotton cloth in France and Alsace-Lorraine arrived at was 248,267 metric tons. No estimates of the annual post-war production of cotton fabric exist. As in the case of cotton yarn, the *Bulletin de la Statistique Générale de la France* publishes regularly the average production per loom per month in pieces of 100 metres, according to reports by the cotton syndicate from factories representing between 30 and 40 per cent of the total number of looms in France. The same source indicates monthly what proportion of looms reporting was idle and what proportion active. This ratio was considered as holding for the entire cotton-weaving industry of France. Furthermore, the syndicate publishes each year in the *Annuaire* the result of an annual loom census which it takes every September 30, thus giving the total number of looms in France. In view of the fact that the increase in the number of looms takes place gradually, each census figure was regarded as indicating the total number of looms in the country six months before and six months after the date of the census. With this data an estimate of the production of cotton fabrics each month was calculated as follows: total number of looms in France × percentage of looms reported each month as active × the monthly average production per loom in pieces of 100 metres × 14, representing the average weight in kilograms per 100-metre piece.

The annual figures were obtained by adding the estimates of the twelve calendar months of each year. For the purpose under discussion hand-looms were counted as one-quarter of a mechanical loom. As the total number of looms reported includes war-damaged looms not yet restored, these latter were deducted each year. The data of the number of looms destroyed in 1920, 1921 and 1923 were taken from M. Dessirier's article in the *B.S.G.F.* Oct. 1924, p. 79. The 1924 and 1925 figures were communicated by the cotton syndicate. The 1922 figure was interpolated, and as no further enumeration was taken in 1926 the number was regarded as the same as in 1925.

in the north. The damaged looms and spindles in 1921 did not represent, however, more than 13.5 per cent of the total number of these machines in France at that date. While this would serve to account for part of the decline in the industry in the early years after the war, the continued low rate of production in spite of the rapid restoration of equipment shows this explanation to be, in all probability, inadequate. The fact remains that, although the productive capacity of France had been very appreciably increased through the acquisition of the textile centers of Alsace-Lorraine, the amount of cotton transformed in greater France since the war, up to 1927, never attained the amount manufactured in France without Alsace-Lorraine in 1913:

	1913 French Production Without Alsace-Lorraine	1926 French Production With Alsace-Lorraine
Cotton Yarn............	243,000 metric tons	229,815 metric tons
Woven Cotton Fabric....	186,000 " "	157,167 " "

If the reasons for this decrease in production are not to be found in the industrial factors determining supply, they must lie principally in the market conditions affecting demand. The market for French cotton manufacture is threefold. There is first of all the home market, which was always the most important both before and after the war. In 1913 and 1926 it absorbed two-thirds of the French production of cotton fabrics. There is also the French colonial market, to which about 60 per cent of the total weight of French cotton exports beyond the yarn stage went both in 1913 and in 1926. The foreign market properly speaking took the rest of these exports.

The apparent [38] consuming capacity of the French home market for cotton fabrics was estimated by deducting net exports from domestic production. In view of the fact that the only production estimates available are those of cotton fabrics produced by the loom,[39] it was necessary to take into account exclusively those foreign trade figures which bear on loom products. Thus the apparent consumption figures given below refer to woven fabrics exclusively:

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[38] Apparent, because no account is taken of the variation of stocks in factories, warehouses and stores.

[39] See above, p. 362, note 37.

Year	Production of Cotton Fabrics (In metric tons)	Net Exports [40] (In metric tons)	Apparent Consumption (In metric tons)
1913 (including Alsace-Lorraine)	248,267	85,434	162,833
1921 " " "	98,964	52,028	46,936
1922 " " "	127,320	37,935	89,395
1923 " " "	137,556	37,789	92,767
1924 " " "	143,722	59,746	83,976
1925 " " "	152,218	47,643	104,575
1926 " " "	157,167	52,615	104,552

It is clear from the above table that even in 1925, when the highest point since the war was reached, the French market (including Alsace) absorbed apparently only two-thirds of the quantity of cotton fabric it had taken before the war.

It would be idle to attempt to enumerate the number of causes that have brought about this falling off in the consumption of cotton fabric in France. There are, for example, such incommensurable factors as changes in style. Certain articles of underclothing which had been made of cotton fell into disuse. The underclothing that survived was made of real or artificial silk rather than cotton. Manufacturers and merchants in the north of France, the east of France and the Lyons region all concur in their opinion that the partial transference of demand from cotton to artificial silk in France was without doubt very important. In addition to the superior attractiveness of artificial silk, it has the further advantage of being consistently cheap,[41] while the price of other textiles is at the mercy of exchange rates or of the fluctuating value of imported raw materials.[42]

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[40] See Appendix E, p. 594. The 1913 net export figure includes 40,000 tons representing estimated exports from Alsace-Lorraine to Germany that year. This estimate is derived from the contingent of Alsatian manufactures allowed free entrance into Germany from Jan. 11, 1920 to Jan. 10, 1921 in accordance with the provisions of articles 68 and 268 of the Treaty of Versailles. Source: *Statistiques des Certificats d'Origine concernant l'Entrée en Franchise douanière en Allemagne* (published by the Chambre de Commerce de Mulhouse, 1925), pp. 6–7. It was not possible to distinguish between fabrics and other cotton articles.

The relatively high price of cotton fabric which prevailed in France after the war was presumably a powerful influence in reducing consumption. From October 1921 to December 1926, the price of calico remained almost all the time more than 50 per cent above the general level of wholesale prices calculated on the 1914 base. It appears from an examination of the accompanying curves (Chart XXV) that the price of raw cotton in francs at Le Havre was probably the principal factor in maintaining the calico quotation at so high a level.[43] Before 1923 the general world-wide industrial crisis and the revival that immediately followed threw into the market a multitude of temporary economic influences which deflected for the time being the movement in the price of calico with relation to that of the price of raw cotton. It is very probable, therefore, that the diminished home consumption of cotton fabrics after the war was due for the most part to their relatively high price. The result was a tendency to substitute other textiles for cotton.

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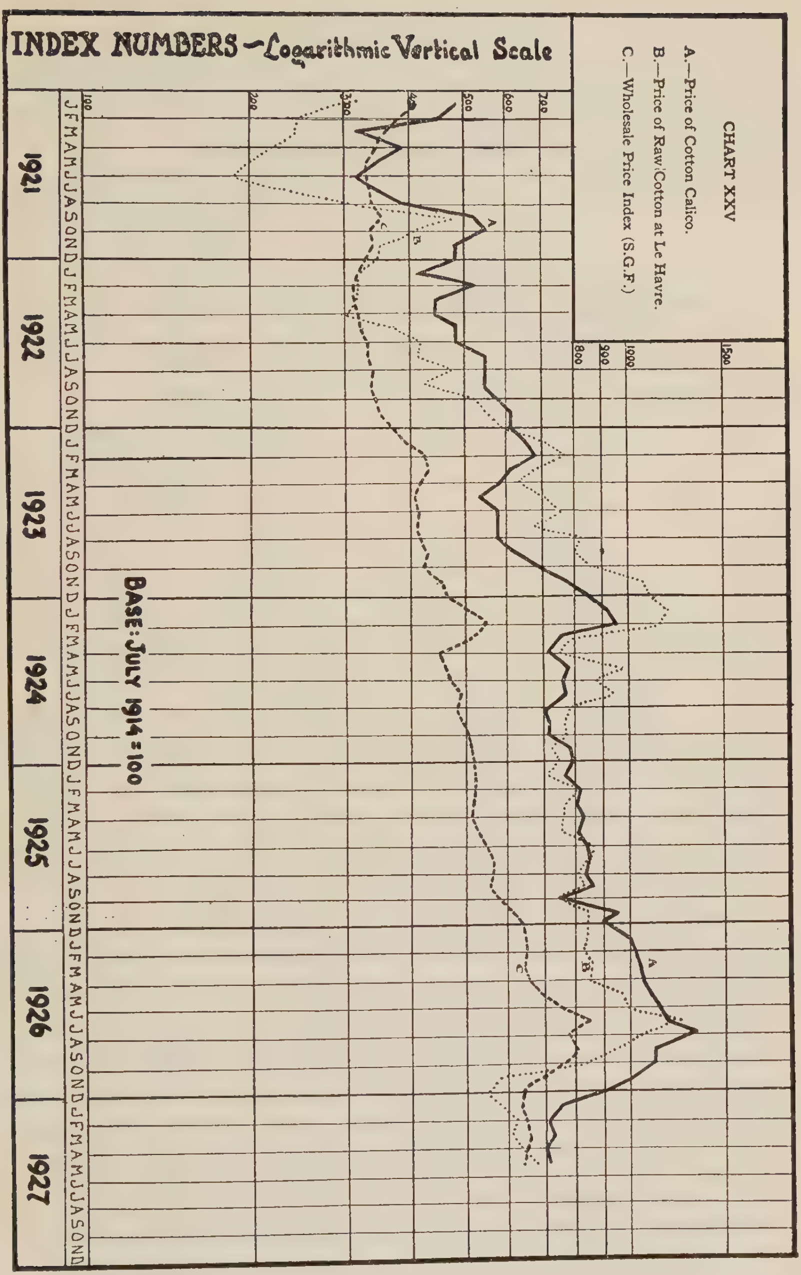
[41] PRICES OF ARTIFICIAL SILK

	Warp Yarn 100 d.	*Weft Yarn 300 d.*	*Price of Cotton Yarn No. 20 1st Quality Rouen, per kilogram*
July 1924	87	60	18.6
Jan. 1925	87	60	17.5
July 1925	87	50	19.2
Jan. 1926	87	50	21.0
July 1926	97	58	....
Dec. 1926	95	55	17.0

[42] It has been calculated for England that the cost of the imported wood pulp constitutes less than 5 per cent of the cost of artificial silk yarn, while the cost of raw cotton constitutes nearly 50 per cent of the cost of cotton yarn. — *The Economist*, June 18, 1927, p. 1277. The situation in France is probably very much the same.

[43] For data up to April 1926, see M. Dessirier, *Bulletin de la Statistique Générale*, April 1926, p. 328. From May 1926 on, see *L'Industrie Textile.*


INDEX NUMBERS—Logarithmic Vertical Scale
CHART XXV
A.—Price of Cotton Calico.
B.—Price of Raw Cotton at Le Havre.
C.—Wholesale Price Index (S.G.F.)
100
200
300
400
500
600
700
800
900
1000
1500
1921
1922
1923
1924
1925
1926
1927
J F M A M J J A S O N D
BASE: JULY 1914 = 100
A
B
C

French Foreign Trade in Manufactured Cotton

The external market fared no better than the home market, for it showed no disposition to absorb the quantities of French manufactured cotton goods it had taken in 1913:

Year	*Exports of cotton goods (fabrics and cotton articles)*
1913 (without Alsace-Lorraine)	55,355 metric tons
1913 (with Alsace-Lorraine)	95,355
1921 " " "	58,654
1922 " " "	43,707
1923 " " "	44,453
1924 " " "	67,132
1925 " " "	55,407
1926 " " "	60,443

In 1924, the banner year since the war, exports of cotton goods from greater France represented an increase of about 21 per cent over the 1913 exports from France without Alsace-Lorraine. This was not in proportion to the 33 per cent increase in the productive capacity of French looms since the reannexation of Alsace-Lorraine. It is to be noted, furthermore, that exports in 1924 were considerably higher than those of the other years. Even in that exceptional year the exports from greater France were only 70 per cent of the estimated exports from the same territory in 1913.

In order to find the principal reasons for this decline in French exports of cotton goods, it is necessary to analyse further the above figures. They include two totally disparate outside markets. The trade conditions that affected the colonial market were very different from those influencing the foreign markets properly speaking. For example, if the exports in each case are subdivided into two constituent categories, cotton fabrics and cotton articles, it is found that in 1913 the colonial market absorbed more than three-fifths of the total quantity of cotton fabrics exported from France, while the foreign market properly speaking absorbed nearly 90 per cent of the exported cotton articles, such as handmade laces, embroideries, passementeries, etc.[44] The value per ton of these latter articles was about three times the value per ton of cotton fabrics exported. Such data alone show how different the two markets under consideration were before the war, and they justify a separate study of each during the post-war period.

Exports to foreign countries declined much more than those to the colonies:

Year	Exports of Cotton Goods[45] to Foreign Countries	Percentage Change from 1913	Exports of Cotton Goods[45] to French Colonies	Percentage Change from 1913
	(In metric tons)		(In metric tons)	
1913 (without Alsace-Lorraine)	27,825		27,993	
1913 (with Alsace-Lorraine)	67,825[a]		36,707	
1921	46,022	−32	12,632	−54 [−66]
1922	26,922	−60	16,785	−39 [−54]
1923	23,791	−65	20,662	−25 [−44]
1924	44,777	−34	22,355	−19 [−39]
1925	26,498	−61	28,909	+5 [−21]
1926	24,104	−65	35,732	+30 [−3]

[a] See above, p. 365, note 40.

The increase in exports to the colonies in 1925 and 1926 over those of 1913 is more apparent than real, for the only 1913 statistics available for this category of exports are those from France not including Alsace-Lorraine. If, however, the French exports to the colonies are increased by one-third (representing the addition of cotton fabric production capacity of Alsace-Lorraine), a theoretic figure of 36,707 tons is obtained which may serve as a pre-war basis of comparison with the post-war statistics. The above percentages in brackets thus indicate the ratio of change from the theoretical pre-war exports to the colonies from France and Alsace-Lorraine combined. While the colonial market was steadily climbing up to its pre-war status of importance as an outlet for French cotton manufactures, the foreign market remained during the whole post-war period very erratic and never came within more than 65 per cent of the 1913 exports to foreign countries from the same territory.

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[44] The total exports of cotton articles in 1913 were 14,048 metric tons, of which only 1,867 metric tons went to the colonies.

[45] Cotton fabrics and articles combined.

The irregular course of exports of French cotton goods to foreign countries after the war was due largely to the peculiar conditions prevailing in the trade relations between Alsace-Lorraine and Germany. The authors of the Treaty of Versailles were well aware that the great cotton industry of Alsace had for more than forty years directed its production almost wholly towards Germany. If the reannexation of that region to France had been accompanied by a brusque commercial separation of Alsace from Germany, the results would have been disastrous for Alsatian industry. In order to allow time for readjustment to the new conditions, articles 68 and 268 of the Treaty of Versailles stipulated for the free entrance into Germany of Alsace-Lorraine products from January 11, 1920 to January 10, 1925. In no case was the annual quota of duty-free imports into Germany "to exceed the average amounts sent annually in the years 1911–1913." Failure to distinguish these exceptional exports from France to Germany from the rest of French exports to foreign countries would lead to confusion.

YEAR	QUOTA OF COTTON GOODS (FABRICS and ARTICLES) ALLOWED FREE ENTRANCE INTO GERMANY [46] (In metric tons)	ACTUAL EXPORTS FROM ALSACE-LORRAINE TO GERMANY (In metric tons)	PERCENTAGE OF QUOTA
Jan. 11, 1920–Jan. 10, 1921	40,067	4,990	12
" " 1921– " " 1922	38,500	16,822	44
" " 1922– " " 1923	34,000	10,961	32
" " 1923– " " 1924	30,500	4,331	14
" " 1924– " " 1925	30,500	18,926	62
Total for five-year period:	173,567	56,030	32

A clue to the reasons for the post-war diminution in the movement of cotton goods from Alsace-Lorraine to Germany is to be found in the statistics of German cotton looms. In spite of a loss of 46,000 looms that went with the cessions of territory on her western frontier and in spite of a further loss of looms to Poland, there were in Germany, in 1925, 240,000 looms [47] as compared with 230,000 in 1913.[48] Germany had thus rebuilt in feverish haste her old colossal industrial edifice, and in a short period became independent of Alsace.

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[46] See above, p. 365, note 40.

Viewed from the Alsatian side the loss of the German market was less gradual than the Treaty of Versailles allowed for, because the collapse of the mark in 1923 was such as to make German purchases abroad extremely difficult. Long before January 10, 1925 the Alsatian manufacturers found themselves obliged to look for other outlets for their products. In the year from January 11, 1924 to January 10, 1925 there was a strong revival in the flow of cotton goods from Alsace to Germany, because of the low exchange rate on the French side with relation to the stabilized Reichsmark. Furthermore, at the close of the period of free entrance, stocks were literally rushed across the border, since that was the last chance for Alsatians to sell and for Germans to buy cotton goods produced under exceptionally low gold cost conditions without the intervention of a tariff barrier.

In 1926, the first complete year during which articles 68 and 268 of the treaty ceased to be operative, the total exports of cotton goods from all of France to Germany fell to but 6 per cent of the exports from Alsace alone in 1924.

Alsatian exports to Germany during the five years of free passage from 1920 to 1925 represented a third of the total movement of cotton goods from France to foreign countries (exclusive of French colonies). They constituted, moreover, 81 per cent of the exports of cotton goods from all of France to Germany. If, therefore, this abnormal disturbing factor be eliminated from the French exports (by deducting the exports to Germany), the following results are obtained:

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[47] *Annuaire* of the Syndicat Général de l'Industrie Cotonnière Française, 1926, p. 68.

[48] Ministère du Commerce, *Rapport général sur l'Industrie française*, Vol. I, p. 601.

Year	Exports of Cotton Goods from France to Foreign Countries Other Than Germany	Percentage of 1913 Exports
	(In metric tons)	
1913 (not including Alsace-Lorraine)	27,041	100
1921 (including Alsace-Lorraine)	21,237	79
1922 " " "	14,688	54
1923 " " "	19,918	74
1924 " " "	24,509	91
1925 " " "	21,192	73
1926 " " "	22,925	85

The percentage of change from 1913 is, in reality, larger than would appear from the above table, because the pre-war figure does not include Alsace-Lorraine, and the post-war figures do. By increasing the 1913 exports by one-third a theoretical figure is obtained which is more comparable with the post-war exports. Thus in 1922 the exports of cotton goods from greater France to foreign countries other than Germany were in reality only 40 per cent of the theoretic exports of 1913 from France and Alsace, and in 1924, 68 per cent.

This diminution in normal exports since the war is not what would *a priori* have been expected. It is all the more striking because it is a decline, not only as compared with the theoretical pre-war figure including Alsace-Lorraine, but even with respect to the actual 1913 exports from France without Alsace-Lorraine. The reasons for anticipating an increase lie in the important part played by cotton articles, as distinguished from fabrics, in the pre-war exports from France to foreign countries, and in the fact that the average price of these articles did not rise either in proportion with the depreciation in the purchasing power of the franc or with the rise in price of cotton fabric exports.[49]

In 1913, the exports of cotton articles which constituted 45 per cent in weight of the total cotton goods exported to foreign countries were worth on the average 13,926 francs per ton, while the fabrics exported averaged 4,642 francs per ton. In 1925, when the price of exported fabrics had risen 880 per cent to 40,575 francs per ton, cotton articles had only gone up 430 per cent to 59,456 francs per ton. The difference was probably due to the fact that the bulk of the cost of production of cotton fabric was in the raw material which French manufacturers had to pay for in American dollars, Egyptian pounds and Indian rupees, while the main costs involved in producing cotton articles were those of skilled labor which was paid for in depreciated francs. In spite of this apparent stimulus to exportation, the quantity of exported cotton articles represented in 1925 only 38 per cent as compared with 45 per cent in 1913 of the total exports of cotton goods to foreign countries, and they remained consistently less than 85 per cent of their 1913 volume:

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[49] See footnote 49 on next page.

YEAR	EXPORTS OF COTTON ARTICLES TO FOREIGN COUNTRIES	PERCENTAGE CHANGE FROM 1913
1913 (without Alsace-Lorraine)	(In metric tons) 12,534	
1921 (including Alsace-Lorraine)	7,782	−38
1922 " " "	6,284	−50
1923 " " "	8,691	−31
1924 " " "	10,563	−16
1925 " " "	9,973	−20

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Year	*Wholesale Price Index, S. G. F.*	*Index of Price per Ton of Cotton Articles Exported*	*Index of Price per Ton of Cotton Fabric Exported*
1913	100	100	100
1921	345	362	431
1922	327	336	529
1923	419	228	710
1924	488	183	884
1925	550	427	880

The post-war exports of cotton fabrics showed no such decline with relation to 1913. If exports from France to Germany be left aside, so as to eliminate the disturbing factor of free trade between Alsace and Germany from 1920 to 1925, and at the same time to make the post-war and the 1913 figures comparable,[50] it is found that the exports of cotton fabrics to foreign countries other than Germany practically attained their pre-war level in 1921 and 1924 and perceptibly exceeded it in 1926:

Year	Exports of Cotton Fabrics to Foreign Countries Other Than Germany[51]	Percentage Change from 1913
	(In metric tons)	
1913	14,507	
1921	13,455	−7
1922	8,404	−42
1923	11,276	−23
1924	13,945	−4
1925	11,219	−23
1926	15,702	+8

It appears, therefore, that the responsibility for the post-war decline in exports of cotton goods to foreign countries lies with cotton articles rather than with fabrics. This raises the question why the exports of these articles since the war were at so low a level, despite their relatively cheap price on the international market. Current theories of foreign trade would have led one to anticipate a swelling in the volume of exports of cotton articles, and a con-

[50] Nearly all the cotton goods exported from France to Germany since the war were of Alsatian origin, and at the same time very little Alsatian cotton went to any other foreign country. Thus, by eliminating exports from France to Germany, for all practical purposes, Alsace is eliminated from the post-war figures and the results are comparable with 1913 exports.

[51] The exports to Germany, which were deducted in order to obtain these figures, comprise cotton articles as well as cotton fabric, because separate detailed figures of these exports to Germany are unobtainable. The resulting error is, however, very slight, since approximations show that fabrics constitute 90 per cent and more of the cotton goods exported from France to Germany. The 1926 figures are provisional, and the total from which exports to Germany were deducted include only three categories: 1. tissus écrus, 2. tissus blanchis, and 3. tissus teints.

sequent increase in the exports of cotton goods, at least over the 1913 exports of France without Alsace-Lorraine.

That there were other factors determining the movements of foreign trade, besides the mathematical relation between price and quantity, is very evident from the statistics of exported French cotton goods. There was, for example, the factor of style, which exercised a no less powerful influence over the foreign market than over the home market. In the United States, in England, in Belgium, in Switzerland and in Argentina, to mention a few of the principal importers of French cotton goods, it is notorious that natural and artificial silks largely replaced expensive cotton laces and embroideries.

Another important factor was the recent industrialization of those countries which formerly imported from abroad practically their whole supply of cotton goods. During the war, when the industrial nations of the world applied every ounce of industrial energy to military purposes, the Far East and the two American continents were obliged to build up their own industry to satisfy their needs. In Japan the number of cotton looms increased from 9,000 in 1911 to 64,500 in 1925, and during the same interval South American looms increased from 54,000 to 73,000 and those of British India from 52,000 to 151,500.[52] In the United States the looms, which numbered 536,000 in 1911, increased to 752,800 in 1925. British industry, the greater part of whose cotton production was destined for export markets, was harder hit than French industry,[53] but French exports were not unscathed:

YEAR	EXPORTS OF FRENCH COTTON GOODS TO	
	United States	Brazil
1913	3,441 metric tons	2,921 metric tons
1926	2,211 " "	755 " "

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[52] 1911 figures from the Ministère du Commerce, *Rapport générale sur l'Industrie française*, Vol. I, p. 601, and 1925 figures from the *Annuaire* of the Syndicat Général de l'Industrie Cotonnière Française, p. 68.

[53] De Rousiers, *op. cit.*, Tome III, pp. 258–261.

It is likely, furthermore, that the slow industrialization which took place in France after the war was partly responsible for a change of emphasis with regard to the nature of exports. More attention was given to trade in cheaper machine-made products than to exports of expensive hand-made articles, probably because the whole productive organism of France was tending that way. This bodes well for the future of the French cotton export market. The erratic fluctuations which have hitherto characterized the exportation of French cotton goods are likely to cease because they will be much less at the mercy of changing styles. As M. Grillet pointed out in 1917: "Most countries, especially England, produce standardized cotton commodities for which there is a large market. France is distinguished by the originality and extreme complexity of her products. More than any other country France is exposed to fluctuations in style, and is thus prevented from accumulating stocks of goods regularly produced in large quantities." [54]

Further evidence of change in the nature of exported French fabrics is found in the recent development of the colonial market. The ratio of exports to the colonies to total exports of cotton goods was just 50 per cent in 1913 and rose to 59 per cent in 1926. This increase in the flow of cotton goods to the colonies implies a vast and important modification in the whole process of fabrication. The native consumer in the colonies demands cheap cotton commodities, which must be specially dyed and highly finished with quantities of starch. The cotton manufacturers of Mulhouse who had formerly turned out high quality fabrics for Germany were obliged to change not only their method, but their scale of manufacturing. Mass production was required if it was to pay. Northrop automatic looms replaced the older mechanical looms.

The conquering of colonial outlets was, moreover, not a simple matter of slow adjustment for France. Other countries, especially England, had set the example and pace. France had to compete for her colonial markets, and in order to compete successfully she was forced to work toward a degree of industrial efficiency comparable with that which prevailed in Lancashire, England. The French realized that it was only in this way that their products could successfully replace British calico which still formed the greater part of cotton goods imported into the French colonies.[55]

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[54] Association Nationale d'Expansion Économique, *Enquête sur la Production française,* Vol. II, p. 175.

The situation of the French cotton industry may be summed up as follows. The productive activity in this branch of manufacture has been pursued, even as late as 1926, at only about three-quarters of its pre-war intensity. What with the reannexation of Alsace-Lorraine, and the completed industrial reconstruction in the north, it is hardly possible that the curtailment in production has been due to any shrinkage in plant equipment. The available data point rather to reduced demand as the most probable cause. The consuming capacity of the home market, which both before and after the war was by far the most important outlet for French cotton goods manufactures, was in 1926 more than a third below its pre-war level. The outstanding reasons for this decrease were the relatively high prices of cotton goods as compared with the price of other commodities and the tendency of changing fashions to prefer other textiles to cotton. The export market has suffered the same fate as the domestic market, but the causes have been infinitely more complex. Germany, for example, made herself after the close of hostilities completely independent of the Alsatian supply, so that when on January 10, 1925, Alsatian cotton goods no longer could enter German territory free of duty, the movement of cotton goods from France to Germany practically ceased. The export of cotton goods to other countries consisted before the war largely of cotton articles rather than woven fabrics, and this diminished too, because fashion no longer favored laces, tulles and embroideries despite the fact that the exchange rate of the franc made them cheaper than they had ever been before. The only encouraging tendency was that of the colonial market, which in 1926 took from greater France a volume of cotton goods in the same proportion as it had taken from France without Alsace-Lorraine before the war. The steady and progressive development of this market is a significant indication of greater efficiency in the industrial organization of the mother country.

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[55] Grillet, *op. cit.*, pp. 178–181.

CHAPTER XIV

TEXTILES II:

WOOL, SILK AND RAYON

1. The Wool Industry

The Production of Manufactured Wool

The post-war wool industry was more prosperous than the cotton industry. According to M. Dessirier's indices the productive activity of the woolen mills of France had by 1926 recovered its pre-war tempo.[1] The accompanying curve (Chart XXVI) indicates only approximately what the fortunes of the post-war wool industry have been. It would be difficult to determine more accu-

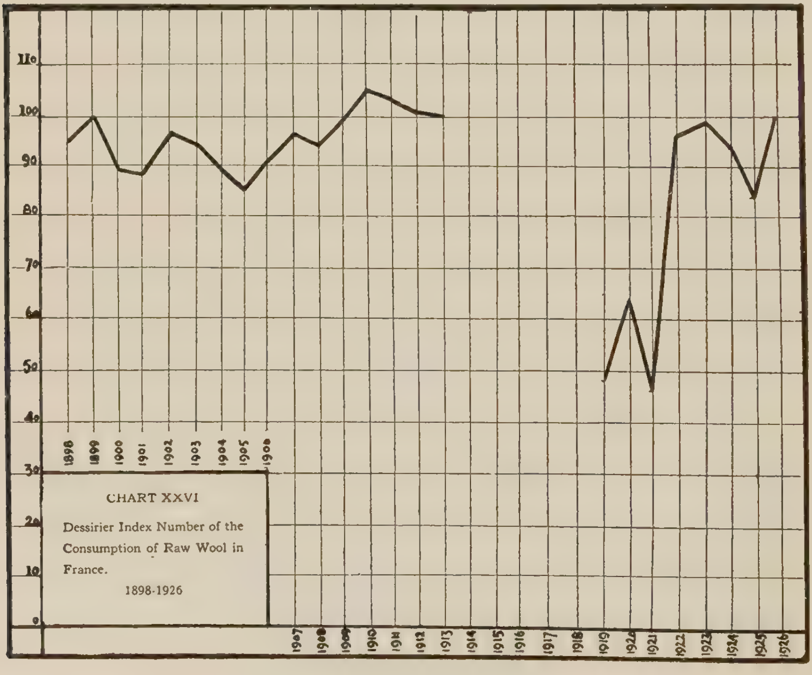

CHART XXVI

Dessirier Index Number of the Consumption of Raw Wool in France.

1898-1926

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[1] For data see Appendix B, p. 586.

rately the changes in output from year to year, in view of the extreme paucity of production data.

It is not impossible, however, to estimate roughly the quantities of new wool spun annually into yarn and the weight of yarn woven or knitted into fabric. The method of calculation employed is that suggested by the report of the *Commission Permanente des Valeurs de Douane* (Session 1924). The yield coefficients given in this report have already been used to determine the weight of imported and domestic shearings in terms of scoured wool.[2] If from these figures are subtracted the net exports of combed wool, carded wool and wool wastes, and also 4 per cent for evaporation, etc., the following results are obtained:[3]

Year	*Quantity of new wool at the disposal of the French spinning industry*
1910	64,546 metric tons
1911	69,596
1912	62,912
1913	72,560
1920	50,242
1921	43,338
1922	96,379
1923	81,996
1924	66,214
1925	83,586
1926	82,652

The amount of wool at the disposal of the French spinning industry may be taken roughly as an indication of the French wool spinning activity. It is not, of course, absolutely accurate, because it assumes no variation in the quantity of stocks, but it is the best that can be had.[4] Furthermore, in the above table the pre-war years do not include Alsace-Lorraine. In order to render them comparable with the post-war years, 25 per cent should be added, representing the ratio of the number of spindles in the reannexed territory to that of the rest of France before the war.[5] If the quantity of new wool at the disposal of the French spinning industry before the war (average 1910–1913) be taken as a base, and the hypothetical production of Alsace-Lorraine be included for the years before the war, the following indices of spinning activity are obtained:

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[2] See above, p. 345.

[3] For data, see annual reports of the Commission Permanente des Valeurs de Douane.

[4] Another element of error inherent in these figures is the fact that only *new* wool was taken into account. No data are available showing the quantity of old wool reworked from rags which enters into French industry.

1910–1913 (average)	100
1920	60
1921	51
1922	114
1923	97
1924	79
1925	99
1926	98

In a similar way it is possible to calculate indices for the production of woolen fabrics, both woven and knitted. It is only necessary to deduct from the amount of wool at the disposal of the spinning mills 6 per cent for wastes, etc., and the net exports of the woolen yarns. The following are, thus, the quantities of yarn which may be said to be at the disposal of the French woolen fabric industry:[6]

1910	52,578 metric tons
1911	56,402
1912	48,760
1913	55,578
1920	46,389
1921	32,767
1922	80,228
1923	67,026
1924	49,240
1925	66,453
1926	62,618

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[5] Thomas, "Les Textiles," *Revue d'Économie Politique*, Nov.–Dec. 1924, p. 1029.

[6] See above, p. 379, note 3.

Again 25 per cent should be added to the pre-war years to account for Alsace-Lorraine, where the number of looms represented about a quarter of those of France. If the average of the four years preceding the war, increased by 25 per cent, be taken as a base, the indices of wool weaving and knitting are:

1910–1913 (average)	100
1920	69
1921	49
1922	120
1923	100
1924	74
1925	99
1926	94

These indices of the spinning and the fabric industries, while showing occasional wide departures from those of M. Dessirier, nevertheless lead to the same conclusion: within a relatively short period after the close of hostilities French wool manufacturing attained again its pre-war level of production.

This was, in fact, a remarkable achievement, for the wool industry had sustained heavy losses during the war from the destruction of machinery, buildings, and raw materials which were situated in the actual fighting zone. By 1925 the reconstruction was practically completed. There are no annual censuses of plant equipment, such as exist for the cotton industry. All that is available are rough estimates of the situation of 1910 and an enumeration of machines made in 1922.[7] A comparison of the figures for these two years shows that there was very little, if any, change for the whole of France in the twelve years intervening. The total number of spinning spindles for combed wool was 1,994,000 in 1910 and 2,292,419 in 1922. The latter figure includes about 500,000 spindles in Alsace-Lorraine, so that it would appear that there had been a decrease in the number of spindles if exactly the same areas be considered for the two years compared. No such conclusion can be drawn, however, because the data are too inaccurate, especially for 1910, to warrant serious consideration of small differences. The number of spinning spindles for carded wool also remained about the same: 682,750 in 1910 and 697,131 (including 16,000 in Alsace-Lorraine) in 1922.

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[7] The data for 1910 were taken from the Ministère du Commerce, *Rapport général sur l'Industrie française*, pp. 539–543; the source for 1922 was *Le Nord Textile*, June 9, 1923, p. 944. The regional comparisons are necessarily only roughly approximate, because the demarcation of the regions is different in the two tables. As far as possible the 1910 divisions were made to correspond with the 1922 geographical regions.

From the point of view of geographical distribution, on the other hand, there was a considerable change. Before the war the principal wool spinning region of France consisted of a belt of land running parallel with the 50° North Latitude circle, extending from Abbeville to Cambrai, Fourmies and Avesne. Here there were over a million combed wool spinning spindles in 1910. This, however, was one of the regions where the war created the greatest havoc. The result was only too clear in the 1922 statistics, which revealed that the number of combed wool spindles had fallen to less than a half a million in this belt. These losses were compensated to a large extent by a remarkable increase in the number of combed wool spindles in the extreme north of France. The Roubaix-Tourcoing district, which lies close to the Belgian frontier, had only about 783,000 combed wool spindles in 1910, but in 1922 took first rank with 1,068,000 spindles. In fact, the twin cities of Roubaix-Tourcoing were not subject to much destruction in the course of the war. Moreover they are very near Dunkirk, where a great deal of the raw material arrives, and they are within easy reach of an abundant labor supply not only in France but in Belgium, whence thousands of workers come daily across the border to work in French factories and then return at night to their Belgian homes.

The regional distribution of mechanical looms was not very different from that of spindles after the war. In 1922, of a total of 55,409 looms in France (including Alsace-Lorraine),[8] about 40 per cent were in the Roubaix-Tourcoing region, 24 per cent in the Abbeville-Cambrai-Fourmies belt, 12 per cent in Alsace, and

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[8] *Le Nord Textile,* June 9, 1923, p. 994. To these mechanical looms for the weaving of cloth and blankets, there should be added 1,400 looms for weaving carpets and about 10,000 hand looms, the dissemination of which in the country districts renders an estimate difficult.

8 per cent in the south of France. For the pre-war period only a rough total estimate exists — 55,000 looms [9] — and there are no statistics indicating their geographical distribution.

In terms of combing, spinning, and weaving machinery, France probably ranked, in 1926, fourth in importance as a producer of manufactured woolens. The only countries more heavily equipped were England, the United States and Germany.[10] Wool machinery statistics, however, are incomplete in most countries. It is impossible, for instance, to obtain figures on the equipment in German wool mills later than the year 1907. Only estimates are available for England. Owing to the fact that France was compelled to replace considerable wool machinery destroyed during the war, the French plants undoubtedly became more efficient in the quantity of output per spindle or per loom than those of many other countries. In terms of the quantity of wool available for consumption in various countries, it appears that France preceded Germany in 1926, and ranked as the third most important wool manufacturing country.[11]

It was, therefore, only natural that post-war France, so well equipped with wool-working machinery, should continue producing on a pre-war scale. The preceding analysis of the French cotton industry has shown, however, that production is not a mere function of technical equipment affecting supply. The quantity of goods manufactured is no less influenced by market conditions, which determine demand. The question therefore arises: what has been the course of the market for French manufactured woolens since the war?

Domestic and Foreign Markets for French Manufactured Wool

In view of the large number of processes involved in the elaboration of wool from the fleece to the finished fabric, wool may be regarded as "consumed" at several stages. The raw wool in the grease is first sorted according to the length and quality of the fibers, and then scoured with hot water and soap in mechanical washing machines. After that it is carded, that is to say, the washed fibers are subjected to a rough combing. Some of the carded wool is spun directly into yarn, and the rest undergoes the "combing" process properly speaking, which consists in a mechanical fine combing of the fibers. These are finally spun into combed wool yarn. The loom then takes the yarns, combed or carded, and weaves or knits them into fabric. Once off the loom, the fabric has still to be finished. It must be needle woven by hand wherever the shuttle has missed a stroke, and then dyed if the dyeing did not take place at the yarn stage. After that there are a multitude of other processes like gassing, sponging, dressing, pressing, etc., to which the fabric is subjected before it is ready for the tailor. From the point of view of this analysis the most significant "consumption" is that of the semi-manufactured product, the yarn, and of the finished product, the fabric.

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[9] Lucien Romier, "L'Industrie lainière," in the report of the Association Nationale d'Expansion Économique, *Enquête sur la Production française*, Tome II, p. 12.

[10] Estimated number of weaving looms for woolens before the war: England, 140,000; United States, 118,000; Germany, 97,000; France, 55,000. Ministère du Commerce, *Rapport général sur l'Industrie française*, Vol. I, p. 595.

[11] Edward T. Pickard, *Special Bulletin No. 412*, Textile Division, U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce.

One of the principal features of the "consumption" of French manufactured woolens is the large part which foreign markets play in absorbing these products at every stage of production. Export statistics reveal very strikingly the high degree of development of French industry at every step in the manipulation of wool. For example, if the scouring, carding, and combing plants of France had not attained a high degree of efficiency in mass production before the war, certainly as much as 25,000 tons would not, at that time, have been sent abroad. Although these exports contained an indeterminable quantity of old wool reworked from rags, and were therefore not strictly comparable with the amount of new wool carded and combed, of which alone it is possible to make estimates, it may still be assumed with fair accuracy that between 20 and 25 per cent of the French production of this partially elaborated woolen product was exported, before 1914. Since the war these exports, beginning with about 15,000 tons in 1920, gradually rose to their pre-war level. The provisional figures of 1926 indicate that about 25,400 tons were exported during that year, representing again perhaps over a fifth of the annual national production. Belgium and Germany were still the most important purchasers, as before the war. France developed a considerable market in Czechoslovakia, and one in England also.

Much of the woolen yarn, too, manufactured in France, found its way across the frontiers. The average annual apparent production of new wool yarn during the four years preceding the war was about 67,400 metric tons. The exports of new and old wool yarns averaged approximately one-fifth of this production during these years. In 1926, when the apparent production of new wool yarn reached the figure of 82,652 metric tons, the exports represented nearly a quarter of the total. Before the war, the two principal purchasers of French yarn were England, taking approximately 50 per cent of the total exports, and Belgium, absorbing more than 15 per cent. In 1926, when the French woolen yarn export market had expanded, there was a considerable falling off in purchases by England, which took only 20 per cent of the total. Belgium, on the other hand, took two and a half times as much in 1926 as she had before the war; and Germany more than doubled her imports of French yarn.

While these French exports were steadily increasing, imports rapidly dwindled. From 1910 to 1913 they averaged 1,153 tons per year, representing 9 per cent of the exports. In 1926 these imports had fallen to the insignificant figure of 566 tons, less than 3 per cent of the exports. Only in 1919 and 1920, before the reconstruction of the French wool mills was well under way, did the imports of these yarns measure in the thousands of tons. Curiously enough, the two main purchasers of French yarn, England and Belgium, were at the same time the principal furnishers of foreign yarn to France. Both before and after the war these two countries sent more than 90 per cent of the woolen yarn exports into France.

The rôle of France in the manufacture of woolens is not restricted to the carding, combing and spinning stages. The quantity of woolen fabrics produced can be only estimated: 53,330 metric tons (average 1910–1913) before the war, and 62,618 metric tons in 1926. These figures, it must be remembered, refer only to apparent production from new wool. A more accurate measure of the importance of the woolen fabric industry is to be found in the foreign trade statistics, where the year-to-year fluctuations in exports of the finished woolen product, whether made of new or of old wool, can be followed:

YEAR	EXPORTS OF WOOLEN FABRICS (In metric tons)	RATIO OF EXPORTS TO APPARENT PRODUCTION OF NEW-WOOL FABRICS
1910	22,331	43%
1911	20,867	37
1912	21,173	43
1913	23,408	42
1920	14,272	31
1921	15,571	48
1922	18,204	23
1923	25,506	38
1924	34,495	70
1925	28,947	44
1926	29,078	46

The pre-war figures are those of France without Alsace-Lorraine, and the post-war figures are those of greater France. A clue to the amount of fabrics exported from Alsace-Lorraine before the war is found in the maximum annual quota of this commodity allowed free entrance into Germany between January 11, 1920 and January 10, 1925.[12] As practically all the exports from this region were directed towards Germany at that time, the 2,300 metric tons quota for 1920–1921 may be taken as the quantity which should be added to the exports of each pre-war year to make comparable the figures for the two periods considered. Thus the theoretical average annual export of woolen fabrics from greater France before the war amounted to 24,244 metric tons. It is seen, consequently, that even when due allowance is made for Alsace-Lorraine, the post-war exports after 1923 kept considerably above the pre-war figures.

This expansion of the export market indicates perhaps more clearly than any other post-war phenomenon how great a stimulus the substitution of the war-damaged outworn equipment by new machinery had given to the economic development of France. The fact is that from 1897 to the opening of hostilities, there had been a relentless decline in French exports of woolen fabrics. During this interval sales abroad had fallen off about a third. This boded ill for the French, because in the meanwhile both England and Germany were rapidly increasing their exports of woolen fabrics. One of the principal reasons for French weakness on the international market before the war was her backwardness in the technique of production. Hampered by antiquated and inefficient machinery, her workmen were unable to produce as much fabric per hour as the English or German workmen. At the same time the French manufacturers hesitated to mechanize their plants, because the coal they would need for additional power was dearer in France than in England or Germany. These rival countries, moreover, possessed commercial organizations well versed in capturing and retaining foreign markets. France was behindhand in this respect.[13]

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[12] See above, p. 365, note 40.

After the war France made a decided effort to catch up, and succeeded, in part at least. Very little was accomplished, however, in the way of commercial organization for exportation. It was found difficult for wool manufacturers to organize for selling in common, on account of the varied nature of the industry and the necessity of constantly modifying methods of work with changes in style. French wool mills as a rule did not specialize in definite products. There was, consequently, a continual setting up of looms for new articles. This hampered regular activity, caused heavy expenses for samples and rendered the market unstable and variable. Although the great variety of production operated to prevent the establishment of any common selling organization, the strength of French manufacturers on foreign markets lies principally in this ability to produce new lines rather than standard lines.[14]

The destination of exports of woolen fabrics shows marked changes between the pre-war and post-war periods. Although England still remained the principal customer for French cloth of all kinds,[15] her purchases fell from 9,283 tons, the average for 1910–1913, to 6,241 tons in 1926. The United States, having become more self-sufficient than it had ever been before, also took less than in the pre-war period. Belgium, Switzerland, Argentina and Turkey, on the other hand, purchased French cloth in unprecedented quantities, especially after 1923.

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[13] Romier, *op. cit.*, pp. 37–38.

[14] E. T. Pickard, *op. cit.*

Another important outlet for French woolen fabrics was the colonies, not so much because of their actual purchases, but principally because of future possibilities. During the four years immediately preceding the war, an average of 771 tons of woolen fabrics of all sorts were exported annually to the French overseas possessions. In 1923 they took 714 tons, and in 1926, 1,309 tons. With the present tendency among natives to adopt European clothes, the colonial market promises to grow enormously.

In the absence of any figures indicating the amount of fabric made in France from old wool reworked from rags (euphemistically called renaissance wool), it is hardly possible even to speculate on the domestic consumption. Since, however, the ratio of exports of woolen fabrics of all kinds to the apparent production of new wool fabrics was considerably greater during the years 1923, 1924, 1925 and 1926 than before the war,[16] it is highly probable that there was a decline in consumption, at least of new wool fabrics, since the war. That this guess is, in all likelihood, correct, would

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[15] These include the following categories in the French *Statistique Mensuelle du Commerce Extérieur*: 1. draps, casimirs et autres, 2. étoffes de pure laine pour habillement, et étoffes mélangés . . . autres:

COUNTRY OF DESTINATION	EXPORTS OF WOOLEN CLOTH (In metric tons)		
	1910–13	1923	1926
United States	1,112	720	947
Belgium	1,452	2,751	2,813
Switzerland	346	1,448	1,122
Argentina	379	1,135	1,160
Turkey	47	596	184

[16] See above, p. 386.

appear, furthermore, from the fact that while French foreign purchases as well as home production of raw wool increased by less than 3 per cent, exports of woolen fabrics went up nearly 35 per cent.[17]

The gain in exports at the expense of domestic production may be explained largely as a function of price phenomena. On the internal market the price of wool maintained itself in post-war years considerably above the general price level of the country:

Year	Wholesale Price Index of Raw Wool in France (Base: 1901–1910 = 100)[18]	French Wholesale Price Index (Base: 1901–1910 = 100)[18]
1923	620	484
1924	1,009	565
1925	972	636
1926	1,168	812

In the case of wool, as in that of cotton, the cost of the raw material is one of the principal elements entering into the price of the finished products. Raw wool having become, therefore, at least 28 per cent (78 per cent in 1924) more costly than the general run of commodities, it is not surprising that the French public consumed less of this particularly expensive textile than it had before the war. This is only one manifestation of the diminished consuming capacity of the French people since the war. The factor of style, to be sure, explains to some extent the reduced consumption of woolen fabrics, but it certainly does not explain all, for other countries, where the same changes in fashion took place, were absorbing more French woolens after 1923 than they had absorbed in the pre-war period.

Just as the relatively high price of wool on the French market helps to account for the probable reduced domestic consumption of this commodity, so the relatively low price on the international market is perhaps the main reason for the increased exports. The coexistence of high prices at home and low prices abroad for the same commodity is explained by the fact that prices on the international market are measured in terms of gold or gold standard currency and are high or low as compared with the gold prices of foreign competitors, while internal prices are quoted exclusively in paper francs, and their elevation or depression is determined by the movement of the prices of other goods within the country. Although the paper franc price per ton of French exports of woolen fabrics in 1926 was nearly nine times as great as that of 1913, in terms of gold francs it is found that the rise amounted to less than 50 per cent. In the meantime, the price of woolens increased much more in gold standard money countries like the United States and England. Such a situation would naturally stimulate French exports.[19]

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[17] Raw wool in terms of scoured wool. The years compared are the averages of 1910–1913 and of 1923–1926.

[18] Source: *Bulletin de la Statistique Générale de la France.*

The imports of woolen fabrics into France followed exactly the opposite course, since the discrepancy between French and international prices was most unfavorable to importation. Even before the war the French purchases of woolen fabrics abroad were never of any great importance. During the four years immediately preceding the outbreak of hostilities, they amounted annually to 4,266 tons on the average, representing about 19 per cent of the exports. Directly after the war, before the devastated industries in the north had been reconstructed, the imports of woolen fabrics took on extraordinary proportions: 22,000 tons (four times the exports) in 1919, and 10,061 tons (74 per cent of the exports) in 1920. When the rehabilitation was about completed, during the

[19]

Year	Index of Volume of Exports (Alsace-Lorraine Accounted for in Base by Adding 2,300 Tons, See Above p. 386)	Gold Price Index Per Ton of Exports of French Woolen Fabrics	U. S. Bureau of Labor Statistics Index of Wholesale Prices of Cloth and Clothing	British Board of Trade Index of Wholesale Prices of Textiles Other than Cotton
1925	112	179	186	189
1926	113	146	161	180

The gold price index per ton of exports of French woolen fabrics was calculated by dividing the indices of the paper franc price per ton of woolen fabric exports by the index of the depreciation of the franc.

four years from 1923 to 1926, the average annual imports had fallen to less than a third of their pre-war volume: to 1,275 tons, representing a little over 4 per cent of the exports. They consisted principally of high grade English cloths and oriental rugs. The great bulk of French needs in the way of woolen fabrics was supplied by the domestic woolen industry, enlarged and renovated since the war.

2. The Silk Industry

The silk industry of France enjoyed unprecedented prosperity during most of the post-war period. It was, in reality, the only great French textile industry that came through the war practically unscathed, since there were very few silk mills in the invaded or war-ravaged regions. In fact, the annual average exports of silk fabrics during 1914–1917 exceeded the average for the four years immediately before the war, and the net exports of silk yarn hardly diminished at all.[20] What hardships the silk industry had to suffer during the war were due to the difficulty of obtaining raw materials, to the loss of skilled labor called to the front, and to the restriction, on account of war-time conditions, of the demand for *articles de luxe* on the domestic and foreign markets, rather than to any extensive physical destruction of plant equipment.[21] As a consequence, once hostilities were over, the obstacles to normal productive activity disappeared almost instantly.

Progress in Silk Manufacturing

The Dessirier index number of silk production in 1919 reveals the unique position of the silk industry at that time.[22] While the

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[20]

Period	Net Exports of Silk Yarn	Net Exports of Silk Fabric
1910–1913 (average)	1,135 tons	4,393 tons
1914–1917 (average)	1,010 “	4,730 “

[21] Albert Aftalion, *L'Industrie textile en France pendant la Guerre*, pp. 175–239.

[22] See Appendix B, p. 586.

cotton and woolen mills, painfully laboring amidst ruins and broken machinery, could turn out only about half of the 1913 volume of production, the conditioning house at Lyons was testing about 90 per cent of the amount of the silk passing through it before the war. That the productive capacity of the silk industry was not impaired is clearly seen in the fact that in the months of June, July, August, November and December of 1919 the Dessirier index numbers exceeded 100 by from 6 to 18 per cent. It is obvious, therefore, that any post-war contraction in silk production, such as took place in 1921, is attributable to national and international commercial and economic conditions only, that is to say, to fluctuations in demand and not in supply.

M. Dessirier's index numbers for the post-war silk output (Chart XXVII) are based on the quantity of silk received at the Lyons conditioning house, where the raw material is tested for the percentage of moisture it contains. As some raw silk is elaborated without ever being conditioned at all, and some is conditioned twice, this

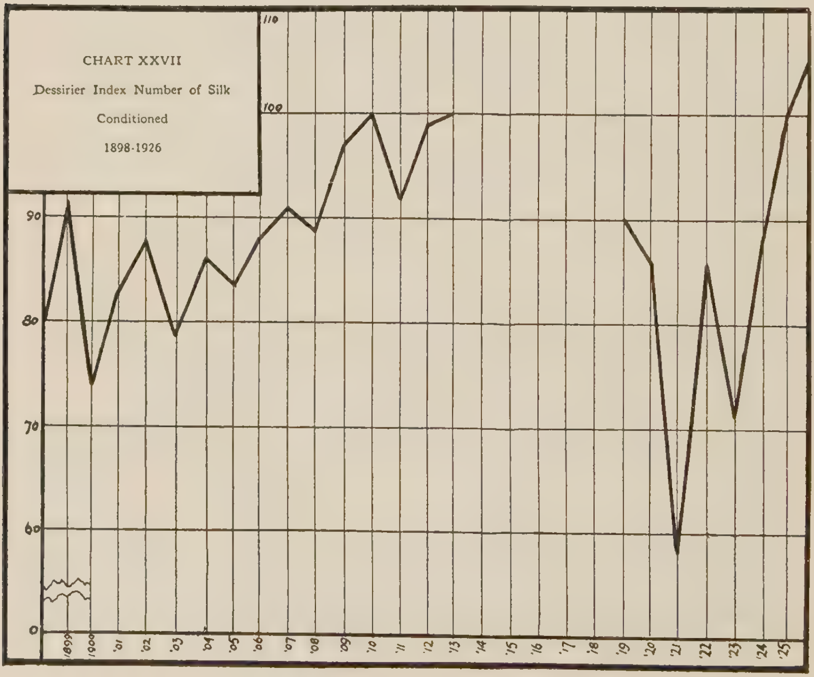
CHART XXVII

Dessirier Index Number of Silk Conditioned

1898-1926

measure of productive activity can only be approximate. There are, nevertheless, other evidences of a well preserved plant equipment which was able to function normally immediately after the war. For example, by the aid of a method of calculation suggested in the reports of the *Commission Permanente des Valeurs de Douane*, it is possible to establish an index number of the annual quantity of silk at the disposal of French industry:[23]

Year	Index of the Quantity of Silk at the Disposal of French Industry	Dessirier Index of Silk Production
1913	100	100
1919	115	90
1920	92	86
1921	64	58
1922	120	86
1923	85	72
1924	145	88
1925	128	100
1926	163	105

What was the geographic distribution which favored silk above all the other textiles? While the center of the woolen industry was the north of France, and that of the cotton industry the northeast, both more or less within the war zone, the silk industry was for the most part situated far to the south, in a wide area around Lyons. Of the 124,000 persons gainfully occupied in the elaboration of silk in 1906, only 4,000 were in the invaded regions.[24] There was a certain amount of silk activity in Roubaix-Tourcoing, in Calais and Caudry, in the north, but here the manufacture of silk yarn, silk fabrics and silk net were accessory occupations. Of the estimated 60,000 to 70,000 power looms for silk in France in 1914,[25] about 70 per cent were in the Lyons region, and the rest scattered about Paris, Tours, and the north of France.

[23] See also, *Bulletin des Soies et Soieries*.

[24] Aftalion, *op. cit.*, p. 176.

[25] Cf. Association Nationale d'Expansion Économique, *Enquête sur la Production française*, Vol. II, p. 77, footnote 2.

The war effected no change in the internal geographical distribution of the industry. Lyons remained the commercial, financial and technological capital of French silk, though relatively little actual manufacturing takes place within the city itself. From 1914 to 1924 the number of power silk looms in the twelve départements constituting the Lyons region increased from 42,413 to 45,454.[26] Moreover the 1921 census indicated that of the 88,379 persons gainfully occupied in the silk industry about 88 per cent were in these départements. Though Lyons was historically the principal center from which the entire French silk industry radiated, it yielded in manufacturing primacy to the surrounding territory. In 1914 less than 6 per cent of the power looms of the region were found in the city itself; and in 1921 the département of the Rhône, within which Lyons and its industrial suburb, Villeurbanne, are situated, contained not quite a quarter of the regional population gainfully occupied in fabrication of silk yarns and fabrics. In fact the silk mills of the so-called Lyons region are scattered over a territory of 72,150 square kilometers (27,857 square miles).

The reannexation of Alsace-Lorraine added little to the production capacity of the French silk industry. The 1921 census recorded only 2,677 persons gainfully occupied in silk manufacturing in the three recovered départements (Moselle, Bas-Rhin, and Haut-Rhin). It is estimated that there were about 4,000 silk looms (spun silk looms included) in this region.[27] Thus the population engaged in the industry was increased by only 3 per cent and the plant equipment by 6 per cent approximately. Another indication of the insignificant part that silk manufacturing played in the recovered provinces is found in the small quantities allowed duty free entrance into Germany by the terms of the Treaty of Versailles from January 11, 1920 to January 10, 1925.[28] The maximum annual quota of silk yarn was that of 1921, and it amounted to 32 tons as compared with 1,384 tons exported from France in 1913. Likewise, the maximum annual quota (1920) of silk fabric was 435 tons which represented about 7 per cent of the 1913 French exports. It was not any part of Alsace-Lorraine, but Krefeld in the Rhineland which had been the main source of manufactured silk for Germany before the war. The supremacy of the Lyons region was wholly unaffected by the post-war territorial changes.

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[26] For 1914 figures, see *Compte-rendu des Travaux de la Chambre de Commerce de Lyon*, 1914, pp. 106–108. For 1924 figures, see *Compte-rendu des Travaux du Syndicat des Fabricants de Soieries de Lyon, Tableau de l'Outillage de la Fabrique lyonnaise.*

[27] Thomas, *op. cit.*, p. 1027.

[28] See above, p. 365, note 40.

The geographic dispersion of the silk industry in the southeast of France was not incompatible with a moderate tendency towards technical progress. This is evident from a comparison of the 1914 loom statistics with those of 1924. In that decade the number of hand looms fell from 17,270 to 5,413, representing a decrease of 69 per cent. At the same time the number of power looms increased by about 7 per cent. The most important increase was that of home-weaving power looms which more than doubled in the ten years. This was the result of the intensified utilization of the hydro-electric potentialities of the region. It became possible for a home weaver to set up a mechanical loom or two in his workroom, thanks to the ease with which a small electric motor could be installed.

With its plant equipment unimpaired, its traditional geographic position undisturbed, and its productive mechanism improved, the silk industry was in an excellent position during the post-war period to increase its output. To what extent production was actually developed is difficult to determine because of the complexity of the process of the elaboration of silk from the cocoon to the silken fabric.

Silk Reeling in France

In view of the fact that both before and after the war more than nine-tenths of the raw silk consumed in France was imported,[29] the industries connected with the very early stages of silk manufacture were of necessity very little developed. The reeling, which consists of unwinding the thread from the cocoon, could be carried on only with the domestic harvest and imported cocoons. Before the war these together yielded on the average (1910–1913) 537 tons of reeled silk per year, representing 10 per cent of the reeled silk at the disposal of French industry. In the four post-war years from 1923 to 1926, the annual average yield in reeled silk from domestic and imported cocoons was 309 tons, representing 6 per cent of the total amount of reeled silk utilized in France. Obviously the little reeling there was in France must have diminished in importance in the post-war period.

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[29] See above, p. 350.

The curious thing about the French silk reeling is that it should constitute an industry at all. In the Far East practically all the reeling is done "on the farm," close to the silk-worm nurseries. The industrialization of this process began in France in 1830 with Genoul's invention of a method of heating by steam the basins in which the cocoons are soaked. More recently, mechanical appliances for brushing the cocoons and power reeling were introduced. The new methods enabled a worker to supervise two basins simultaneously. The post-war technical progress realized is seen in the fact that the number of kilograms of silk reeled per basin increased from 58 in 1913 to 82 in 1924. Nevertheless, the process, being extremely delicate, was far from automatic. As the industry was hemmed in on the one hand by technical limitations, and on the other hand by the relatively scanty quantity of cocoons which the domestic harvest produced, it remained, as the following figures show, a small-scale affair:[30]

Year	Number of Reeling Mills	Silk Reeled (In tons)	Silk Reeled per Mill (In kilograms)
1900	257	773	3,008
1905	226	758	3,354
1910	214	772	3,607
1913	166	654	3,940
1919	86	272	3,167
1920	87	292	3,360
1921	78	274	3,495
1922	83	296	3,566
1923	83	310	3,735
1924	85	334	3,929

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[30] This long-trend decline in sericulture and the silk reeling industry took place despite desperate efforts on the part of the Government to encourage silk-worm raising

Silk Throwing in France

So elementary is the process of reeling that generally reeled silk is called raw silk and manufacturing is regarded as only beginning with the "throwing" of silk, which yields silk yarn. Throwing is the technical term for twisting, the reeled thread being twisted on itself or together with one or more other threads. This stage in the elaboration of silk is for the most part carried on in specialized factories, although there are still vestiges in the center of France of antiquated rural workshops where throwing constitutes a semi-agricultural pursuit. Throwing lends itself much more readily than reeling to large-scale production, because practically all the imported as well as domestically grown silk is its potential raw material.

Neither before nor after the war did the silk-throwing mills of France reflect the growing prosperity of the silk industry. The same decadence already noticed at the reeling stage affected the throwing industry. In 1889 there were in France 708 throwing mills and more than 2,100,000 spindles. Thirty years later there were no more than 590 mills and 1,100,000 spindles. It is estimated that in the post-war period the number of spindles was only 750,000, and the output, which had amounted to 3,000,000 kilograms in 1889, fell to 1,500,000 kilograms after the war.[31]

The reason for this decline is the great instability of conditions under which this industry labors. If it is not as dependent as reeling on the domestic harvest of silk, its activity is a function of something still more fickle, style. The fashion of the day may call for a fabric made of untwisted silk, that is to say for a fabric woven directly from reeled silk. Or it may call for fabrics of slightly twisted, or again highly twisted, yarns. The fortunes of the silk thrower are at the mercy of these changing whims. As a consequence, the silk throwers of France were in a sad financial plight

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and reeling. A law was passed on January 13, 1892, slightly modified from time to time, which was in vigor during the post-war period, granting bounties not only per kilogram of cocoons raised in France but also per reeling basin constructed and per hour of reeling per basin. Nevertheless, the number of basins in France, which amounted to 11,285 in 1913, was only 4,054 in 1924.

[31] Louis Gueneau, *Lyon et le Commerce de la Soie*, p. 115.

on the eve of the war. Most of them lost their status of independent manufacturers and simply twisted silk "to order" for either importers or weavers. Some even sold out their plants to the big weavers who thus integrated their industry by annexing the previous process.

In the post-war period the silk throwers began to regain some of their independence, and the industry which was on the point of becoming simply an annex of the importer's warehouse or the weaving mill, recovered part of its lost autonomy. 1919 was an especially busy year, though the cost of throwing had risen to five or six times its pre-war level. The reason was simply that current style called for crêpe fabrics made of highly twisted silk yarns.[32] The general post-war prosperity transformed the silk throwers from the state of beggars at the door of importers and weavers into manufacturers in a position to command the silk merchants of Lyons.

Despite this amelioration of the business conditions of the throwing industry, the actual productive activity showed a general tendency to diminish. In the absence of any production statistics, the foreign trade figures shed a suggestive light on the fluctuations in output:

Year	Net Exports of Thrown Silk (In tons)	Percentage Change from Pre-War Average
1910–1913 (average)	1,283	
1919	144	−89
1920	167	−87
1921	347	−73
1922	563	−56
1923	372	−71
1924	353	−72
1925	580	−55
1926	442	−66

Before the war the net exports of thrown silk amounted to 1,283 tons per year (average 1910–1913)[33] but in the post-war period these net exports declined by more than half, as the table on the preceding page indicates.

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[32] Louis Gueneau, *op. cit.*, p. 14.

[33] Dyed and undyed in terms of undyed thrown silk. See annual reports of the Commission Permanente des Valeurs de Douane.

The significant fact about this decline in net exports is that it was not due so much to a diminution in exports, which might simply indicate that the home weaving industry was requiring more of this semi-manufactured production than it did before the war, as to an astounding rise in imports.

Year	Exports of Undyed Thrown Silk[34] (In Tons)	Percentage Change from Pre-War Average	Imported Undyed Thrown Silk (In Tons)	Percentage Change from Pre-War Average
1910–1913 (average)	1,242		6	
1919	512	−59	417	+6.9
1920	436	−65	328	+5.4
1921	436	−65	143	+2.3
1922	639	−49	120	+1.9
1923	456	−63	112	+1.8
1924	453	−64	113	+1.8
1925	641	−49	92	+1.4
1926	539	−53	118	+1.9

There can be no doubt that the French silk throwing industry was yielding ground to the expanding Italian silk throwing industry, for it was principally from Italy that the increased imports were coming.

The French Spun Silk Industry

Not all silk arrives at the yarn stage by throwing. Some of it is spun. At every stage in the elaboration of silk there are wastes, which consist of broken bits of silk, known as floss, unlike the long unwound thread of the cocoon, but capable of being spun into yarn very much in the same way as cotton or wool. This very similarity of process led to a geographic distribution of the industry closer to the cotton and woolen centers of France. While Lyons is the capital of this, as of all other branches of silk manufacture, and although the Lyons region contains a great many silk-floss combing and spinning mills, there are a large number of mills having no connection with Lyons and found around Troyes, close to the wool area, and at Croix-aux-Mines in the cotton manufacturing districts of the east.[35]

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[34] Undyed thrown silk figures were used to the exclusion of dyed thrown silk because the foreign trade statistics combine this latter category with silk sewing thread from 1925 on.

As by far the greater part of the floss silk utilized in the spun-silk industry is derived from reeling rather than from later processes, the floss of domestic origin in France forms but a small proportion of the total.[36] Most of the floss is imported, and the principal source is China. The *Commission Permanente des Valeurs de Douane* publishes annual estimates of the amount of floss in terms of combed floss at the disposal of the French spun silk industry.[37] The following indices show clearly that the fortunes of this industry were favored in the post-war period:

Year	*Index number of combed floss at disposal of silk spinning mills*
1910–1913 (average)	100
1920	72
1921	64
1922	101
1923	92
1924	126
1925	122
1926	117

This tendency of the French spun silk industry to expand is one of long standing. It began to develop on the scale of modern enterprises about 1875, and it has continued to grow ever since, in spite of very serious competition in Switzerland and England. The reason is the vulgarization of the use of silk in contemporary clothing, which calls for ever cheaper ingredients in the fabric having the same aspect as thrown silk fabrics. Moreover, spun silk is employed very largely for manufacturing silk plushes and velvets used increasingly for furniture upholstery. So great, in fact, was the post-war demand for spun silk yarn that the French plants, though steadily increasing in their productive capacity, proved inadequate to satisfy domestic demand. This is seen in the foreign trade statistics which reveal an important excess of imports after the war, whereas there had been an excess of exports before:

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[35] Louis Gueneau, *op. cit.*, p. 241.

[36] The estimated average yield of 100 kilograms of dried cocoons is as follows: 60 kgs. chrysalid, 25 kgs. reeled silk, 15 kgs. floss.

[37] 100 kilograms of floss yield: 45 kgs. waste, 45 kgs. spun silk, 10 kgs. silk noil.

Year	*Trade balance in spun silk yarns (excess of exports = +; excess of imports = −)*
1910	+782 tons
1911	+930
1912	+1,009
1913	+605
1919	−191
1920	+176
1921	+593
1922	−274
1923	−850
1924	−129
1925	−50
1926	−106

The Manufacture of Silk Fabrics

The true strength of the French silk industry is seen at the weaving and finishing stage. In point of quantity of production, post-war France fell from the comparative rank she had held before the war among the nations of the world, but this was due rather to the extraordinary progress realized by others than to any lack of expansion within France. There are unfortunately no statistics available measuring precisely the silk weaving output.

An exceedingly rough estimate of production is that which may be obtained by the application of a method devised by Professor Aftalion:[38]

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[38] Albert Aftalion, *op. cit.*, pp. 201–208. The supply of spun silk yarn was computed by deducting 10 per cent for waste from the amount of combed floss at the disposal of French industry (see annual reports of the Commission Permanente des

SUPPLY OF REELED, THROWN AND SPUN SILK AT THE DISPOSAL OF THE SILK WEAVING INDUSTRY OF FRANCE
(In tons)

Year	Reeled and Thrown Silk	Spun Silk	Total	Index Numbers
1910	4,262	1,330	5,592	100
1911	4,078	998	5,076	
1912	4,663	1,150	5,813	
1913	4,071	1,597	5,668	
1919	4,670	1,230	5,900	107
1920	3,750	1,336	5,086	92
1921	2,577	749	3,326	60
1922	4,873	2,405	7,278	131
1923	3,452	2,774	6,226	113
1924	5,913	2,777	8,690	157
1925	5,211	2,608	7,819	141
1926	5,597	2,567	8,164	148

No account is taken in these figures of variations in the accumulation of stocks of raw materials. And furthermore, the above indices are defective because they show nothing of the utilization of wool, cotton, linen, and artificial silk, which are more and more frequently mixed with genuine silk. They are, nevertheless, the best index numbers available, and they reflect faithfully the economic and international incidents affecting the industry. For example, the drop to 60 in 1921 is attributable to the world-wide crisis of that year; and the decline in 1923 is probably due to the earthquake in Japan in September of that year, after which American importers hurriedly bought in China and Italy bales of raw silk which would otherwise have gone to France. The high figure of 157 for 1924 probably represents the replenishing of stocks which had been eaten into at the end of the previous year rather than any brusque movement in production. The general conclusion which the above series of index numbers leads to — and this may be taken as fairly accurate — is that the silk-weaving activity of post-war France was about 50 per cent greater than that of pre-war France.

Valeurs de Douane) and then by adding or subtracting respectively the excess of imports or exports of spun silk yarn.

A detailed examination of the statements of the value of output reveals an interesting change within the industry with respect to the nature of the silken fabrics manufactured. Before the war the bulk of the silk woven in the Lyons area consisted of heavy piece goods (*tissus de soie et de bourre de soie unis et façonnés*), which represented in value 44 per cent of the total production (average 1910–1913). In the post-war period this percentage fell as follows:

1922	37%
1923	36
1924	32
1925	28

At the same time the light piece goods (*gazes, crêpes de chine et mousselines*), which were cheaper per unit of length, and consequently within the reach of a larger public, took on a constantly increasing importance in the total output, as the following percentages indicate:

Year	*Percentage in value of light piece goods to total silk fabric production in Lyons area*
1910–1913 (average)	26
1922	41
1923	40
1924	45
1925	53

This change is very significant, for it indicates a tendency on the part of Lyons manufacturers to turn away from highly expensive heavy fabrics, on which they had built a world-wide reputation of long standing, to cheaper standardized piece-goods. In taking this new direction they expose themselves to dangerous competition from the country of mass production *par excellence*, the United States.

Although American silk mills consumed before the war more than three times as much silk as France,[39] Lyons was still the pivot of the world silk market, by virtue of its longer experience and its older connections with the Far East. As a result of the war, which made the foreign trade of France extremely difficult to carry on, and as a result mainly of the colossal expansion of the American silk industry during and after the war, Lyons ceased to be the dominating market of the world. This rôle passed on to New York, which is the principal distributing center for the silk mills in New Jersey. The American importers freed themselves from dependence on the intermediary markets of Europe (Lyons, Milan, Zurich, and London) and purchased the raw material directly from the Far East (for the most part from Japan) to be shipped across the Pacific either to San Francisco or to New York by way of the Panama Canal. No longer do the silk merchants of Lyons dictate current prices; post-war quotations emanate from New York. What wonder, when it is seen that post-war America consumed not three times as much silk as France, as before the war, but five and six times as much:

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[39] While more silk was conditioned at Milan, Italy, than at Lyons (in 1913, 8,414 tons in Lyons and 9,496 tons in Milan), Lyons exercised a greater influence, for Milan was largely an entrepôt for Lyons importers.

CONSUMPTION OF REELED AND THROWN SILK IN FRANCE AND THE UNITED STATES

(In tons)

Year	France	United States
1913	4,071	12,235
1919	4,670	20,115
1920	3,750	13,300
1921	2,577	20,395
1922	4,873	20,095
1923	3,452	22,772
1924	5,913	22,950
1925	5,211	28,675

French Exports and Domestic Consumption of Manufactured Silk

The increased production in the United States was not accompanied, as might have been expected, by any diminution in exports of manufactured silk from France to the United States. On the contrary, as is seen in the following table, the visible exports [40] of silk fabrics from France to the United States were from 33 to 75 per cent greater than they had been before the war:

Year	*Exports of silk fabrics [41] from France to the United States*
1913	763 tons
1920	1,139
1921	1,073
1922	1,037
1923	1,346
1924	1,243
1925	1,131
1926	1,261

This was undoubtedly due to the rapidly increasing American demand with which the growth of domestic industry could not keep pace. There was, perhaps, another reason too, equally potent, which explains the maintenance and increase of the flow of manufactured silk from France across the Atlantic. While the United States had mastered the technique of standardized quantity production, it was still obliged to turn to the manufacturing centers of the old world for products of a highly artistic character. Lyons is the home and source of arts, patterns and designs which are practically inimitable, and it still has an old guard — rapidly diminishing, to be sure — of hand-weavers who turn out articles of great luxury, especially made for export.

The French silk-weaving industry manufactures essentially for export. From whatever quantitative angle one may approach the problem, it always appears that by far the greater part of silk goods fabricated in France is destined to be sent abroad. For example, if the value estimates of production are compared with the value of exports the following results are obtained:

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[40] No account is taken in these statistics of exports in the form of parcels post and in the form of tourists' purchases.

[41] Including tulles, laces, embroideries, passementeries, etc.

Year	Estimated Value of Silk Fabric Production in France [42] (Millions of francs)	Value of Exports of Silk Fabrics (Millions of francs)	Percentage Exported
1913	673	386	57
1919	2,213	1,452	66
1920	3,351	2,093	62
1921	2,316	1,262	55
1922	3,003	1,611	54
1923	3,764	2,083	55
1924	4,461	3,021	68
1925	5,658	3,569	63
1926	6,692	4,456	67

If the quantitative estimates of production are compared with the quantitative export statistics, the results are far more striking, not to say astounding:

Year	Estimated Production of Silk Fabric [43]	Silk Fabric Exported
1913	5,668 tons	6,175 tons
1919	5,900	6,012
1920	5,086	7,570
1921	3,326	5,656
1922	7,278	6,340
1923	6,226	7,609
1924	8,690	8,604
1925	7,819	9,259
1926	8,614	9,200

The apparently absurd anomaly of the superiority of export over production figures is due not only to the inadequacy of the output estimates, but also to the fact that these latter statistics are based simply on the quantity of reeled and thrown natural silk at the disposal of the weaving industry, while the export statistics include mixtures of silk and other textiles and also rayon fabrics. The above table serves, nevertheless, to confirm the impression of the previous table that most of the silk woven in France was exported both before and after the war.

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[42] The estimate was made on the basis of the value of silk goods produced in the Lyons and St. Étienne areas as reported by the Syndicat des Fabricants de Soieries de Lyon to which 18 per cent was added, representing the probable proportion of production in other parts of France. *Cf.* Aftalion, *op. cit.*, p. 237; and Pierre Clerget, *Les Industries de la Soie en France*, p. 183. The 1924–1926 figures were taken directly from the annual reports of the above mentioned Syndicat.

[43] See above, p. 402.

The increased production and the unprecedented prosperity of the French silk export trade after the war were the consequence of the rapidly advancing consumption of silk the world over. Even before the close of the war the French export market was expanding. This was due to the fortunes made by the neutral countries in supplying the belligerents with war materials. Whole populations became suddenly enriched and bedecked themselves in silk. In 1916 the exports of silk goods from France to the United States were just twice as great as they had been in 1913. Exports to Spain quintupled, those to Argentina more than doubled, and those to Brazil more than quadrupled.[44] Even the Allies of France, occupied as they were with the grim task of fighting, continued to purchase French silks — perhaps because in these countries too the war brought undreamed-of riches to certain classes of the community. Exports to England had fallen off by about a third in 1917 (the lowest war year), but those to Italy were considerably higher than in 1913 for every war year except 1918.

The popularization of silk, not only for dresses but also for underclothing, is one of the striking characteristics of the post-war period, so far as apparel is concerned. When only heavy silks were used they were within the reach of but a small number of purchasers. The fashion of light silks and of silks mixed with less expensive textiles made it possible for persons of limited means to have silk clothing. Moreover the substitution of power looms for the slow, toilsome hand looms reduced considerably the labor item in the production costs. Finally, though silk remained still intrinsically an expensive material, its price was less affected than that of the other great textiles, cotton and wool, by the economic upheavals brought about by the war. A rough calculation was made by the *Institut für Konjunkturforschung* of Berlin [45] showing the relative increase in price of silk and its rival materials:

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[44] Aftalion, *op. cit.*, pp. 230–233. After the entrance of the United States into the war French silk exports to that country fell below the pre-war level.

	PERCENTAGE OF INCREASE IN PRICES IN 1924 AS COMPARED WITH 1913 (Base: 1913 = 100)
Textiles in general	197
Wool	193.9
Cotton	207.5
Silk	169.8

Another proof that silk became a relatively cheaper material after the war — all other conditions being equal — than cotton and wool is seen in a comparison of the rise in price of silk goods exported from France with that of woolen goods:[46]

YEAR	INDEX NUMBER OF GOLD PRICE [47] PER KILOGRAM		U. S. WHOLESALE PRICE INDEX (Bureau of Labor Statistics)
	Exported Woolen Goods	Exported Silk Goods	
1913	100	100	100
1920	253	160	226
1921	200	140	147
1922	208	172	149
1923	174	139	154
1924	202	152	150
1925	179	152	159
1926	151	129	151

It would seem from the above table that the increase in the price of exported French silk goods in gold was for most years below the general level of increase in the wholesale prices of the United States. These were indeed conditions that would stimulate the foreign demand for French silks.

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[45] Cited in the League of Nations, International Economic Conference, *Natural Silk Industry*, p. 17.

[46] Cotton goods were not compared because the nature of cotton exports from France changed too much.

[47] Paper franc prices were roughly deflated on basis of average annual dollar-franc exchange rate.

It is not at all astonishing, therefore, that French exports should have increased very considerably in the post-war period as compared with the pre-war days:

Year	Percentage Change in Manufactured Silk Goods Export Trade of France from 1910–1913 (Average)	
	(In weight)	(In gold francs)
1920	+41	+130
1921	+5	+51
1922	+18	+110
1923	+42	+100
1924	+60	+149
1925	+72	+167
1926	+71	+140

The general alignment of importers of French manufactured silk goods was not very different after the war from what it had been before. England still remained at the head of the list. Although the absolute weight of silk goods sent across the Channel was often superior to the 1913 quantity, relatively it diminished in importance:

Year	Silk Goods Exported to England	Proportion of Total Silk Goods Exports Going to England
1913	3,468 metric tons	56%
1923	3,483	46
1924	3,726	43
1925	4,395	47
1926	3,460	38

The United States held second rank before and after the war. The proportion of the total French silk exports going to this country was only slightly higher than it had been in 1913. Belgium retained its pre-war position of third place, always taking between 7 and 8 per cent of the French exports. The most significant change is that noted in the case of Argentina, which after the war was fourth among the importers of French silks:

Year	Silk Goods Exported to Argentina	Proportion of Silk Goods Exported Going to Argentina
1913	63 metric tons	1%
1923	472	6
1924	316	4
1925	370	4
1926	520	6

Switzerland, Italy and Spain all took considerably greater quantities than they had imported in pre-war days. The exports to Germany were extremely erratic — now affected by foreign exchange and now by tariff conditions.

While ever increasing quantities of manufactured silk goods were being shipped from France to foreign lands, France herself, so far as may be determined, consumed but a modest portion of this *article de luxe*. There is no way of telling even approximately how much silk fabric remained to be worn ultimately by the French. No estimates exist of the quantity purchased by tourists and thus exported "invisibly." Furthermore, much that was retained in France in the form of piece goods finally found its way out as manufactured clothing.[48] Available indications of domestic consump-

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[48] The weight of visible exports of articles of clothing made of silk (1. vêtements confectionnés pour hommes, etc., 2. vêtements confectionnés pour dames en soie, and 3. cravates en soie) rose in the following proportions:

1913	68 metric tons
1923	385
1924	447
1925	462
1926	455

tion imply stagnation if not decline. For example, imports of silk fabrics into France fell from 978 tons before the war (average 1910–1913) to 319 tons after the war (average 1923–1926). This was partly due to a greater self-sufficiency of French industry, especially as regards silk velvet which formerly came in large quantities from Germany, but it was also due to a diminution in demand for Asiatic and English fabrics (velveteens) which France never learned to manufacture. If the value of net exports be deducted from the estimated value of silk goods produced in France,[49] it is found that the difference, which represents presumably the value of French consumption, constituted in the post-war years a smaller proportion of the value of domestic production than it did before the war:

Year	*Ratio of value of apparent consumption of French silk goods to estimated value of production*
1910–1913 (average)	57%
1920	44
1921	49
1922	47
1923	47
1924	35
1925	39
1926	36

3. The Rayon Industry

The rayon industry [50] may, from the point of view of the similarity of the product and the ultimate uses to which it is put, be considered as a branch of the silk industry. In fact, the foreign trade and production statistics of most countries present rayon as a subdivision of silk. Still, as has already been said in the above discussion of raw textiles, the chemical fiber, rayon, and the animal product, natural silk, have nothing in common and are in reality poles apart up to the throwing and weaving process.

The very newness of the rayon industry contrasts sharply with the antiquity of the silk industry, the origins of which go back to man's dim and unknown past. The first rayon factory of the world was founded in the early nineties of the last century at Besançon, but as the output figures show, this young industry has become the world over an *enfant terrible.* Moreover, the geographic distribution of the rayon factories is very different from that of the natural silk mills. There is no concentration around Lyons or in the Lyons area. Rayon factories are scattered all over the industrial territory of France: in the east and in Alsace, where rayon yarn is mixed with cotton; in the north, where it is mixed with wool; in the Paris region, where it is used in the manufacture of Parisian novelty fabrics; and finally in the Lyons region, where only recently it has been admitted into silk mills to be mixed with natural silk. Paris rather than Lyons is the financial and technical capital of this industry.[51]

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[49] See above, p. 406.

[50] Rayon is the trade name for artificial silk.

The earliest French production estimates are those of 1901, when France is said to have produced a half a million kilograms of this new fiber as compared with a million and a half kilograms produced in the world at that time. Then it was that France held first rank in this industry. By 1913, however, though French production had increased substantially to about a million and a half kilograms, in relative position France fell behind Germany (3.5 million kilograms) and England (3 million kilograms). The war set France even further back. The factories in the north and east had been seized by the enemy. Those in the south were undermanned. Meanwhile Germany, whose supply of natural textiles was almost completely cut off by the four years' blockade, was forced to push to the utmost the cellulose textile industry which is basically the same as the rayon industry. Consequently, France found herself running far behind at the beginning of the post-war period, as is clearly seen in the following diagram[52] (Chart XXVIII). The country that took the lead, increasing her output by leaps and bounds in the post-war period, was the United States. The Italian production too grew at a phenomenal pace.

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[51] Louis Gueneau, *op. cit.*, pp. 247–253.

[52] For data see League of Nations, International Economic Conference, *The Artificial Silk Industry.*

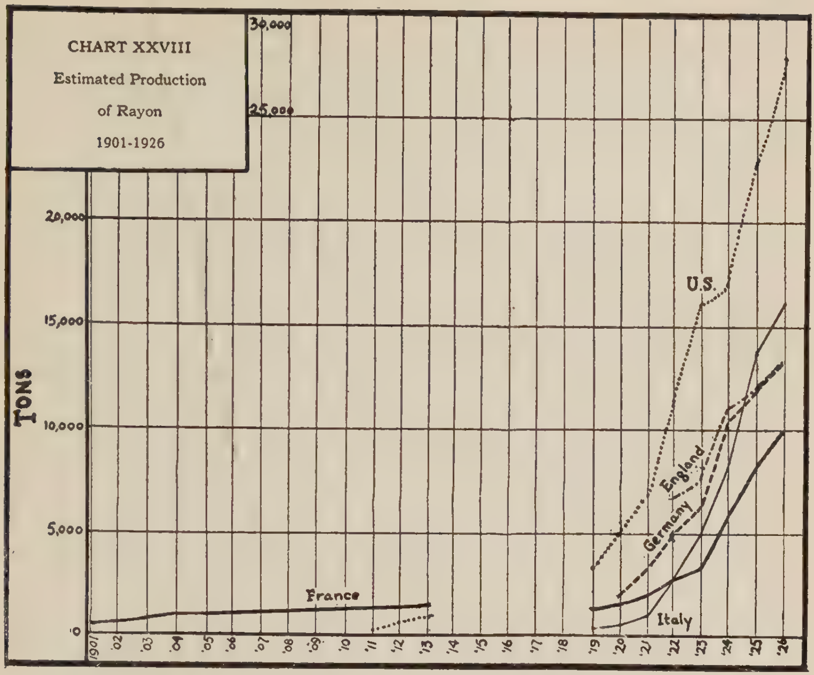

CHART XXVIII
Estimated Production
of Rayon
1901-1926

The reasons why France fell behind other countries, in spite of the very important development of her rayon industry, are highly complex. Her relative position depends as much upon special conditions in the other countries compared with France as on the industrial situation of France herself. For example, a great impetus was given to rayon manufacturing in the United States, not only on account of the demand for rayon in that country, but because of the mechanical efficiency which characterizes all industry there. Italy profited by the abundance of cheap labor. Germany's production swelled in the post-war period because natural textiles became prohibitively expensive during her monetary crisis, and also because her chemical industries were so extensive and so highly efficient. In France, the rate of increase of the rayon output was limited by the general rate of development of the French chemical and textile industries, by the supply of labor, capital, foreign and domestic market demands, etc.

Though there are four different processes for the making of rayon fiber, they all may be described in simplest terms as consisting of converting cellulose (of cotton or wood-pulp origin) into a liquid viscous pulp, which, when pressed through capillary tubes, changes into a fiber made to coagulate on contact with a certain solution. The earliest known process, the nitro-cellulose (Chardonnet), did not survive very long in France. By 1925 it had disappeared entirely.[53] About nine-tenths of French rayon is produced by the viscose process, the acetate and the cupra-ammonium processes taking care of practically all the rest.

The rayon industry is, in France as everywhere else, industrially and financially highly concentrated. In 1925 there were altogether only 18 factories in actual operation in the whole country, although 14 more were being planned or were under construction at that time.[54] This multiplication in plants simply responded to the rapidly growing demand. Thirty-one of the 32 factories had a capacity of a ton a day or more. Since the establishment of a modern rayon enterprise requires a comparatively large capital investment and a costly technical and experimental staff, financial concentration is a necessary corollary. In 1926 the French rayon industry was dominated by organizations which generally controlled plants in two or more countries and whose financial backing and technical direction were international in character. Among these huge international organizations there was the viscose group in which the French played a leading rôle. They participated to a lesser extent in the Belgian group (*Société Belge de Tubize*) and the Dutch group (*Consortium International de la Soie*).[55] In France production was practically controlled by two groups, the *Société Nationale de la Viscose* and the *Société Générale de Soie Artificielle.* In fact few industries have become so concentrated within national territories, or so internationally intertwined, as the artificial silk industry.

Combination went hand in hand with concentration. The two French groups above mentioned, far from competing with each other, had certain factories under their joint control, and combined to form a vast sales agency known as the *Comptoir des Textiles Artificiels*. Several firms not belonging to either of the two groups became members of the *Comptoir*, so that this organization is said to control the production and distribution of at least four-fifths of the French output.[56] Furthermore, as a result of its appointment as agent of the great British Courtaulds concern, which exports considerable quantities of yarn into France, the *Comptoir*, in effect, controlled importations from abroad as well. It may be said that in 1926 the entire French industry was under a single direction for the regulation of production and sales. The monopolistic character of the rayon industry ceased to be national and became European in 1927, after the expanding world-wide production threatened to exceed demand in 1926. At first a combine was formed between the Courtaulds in England, the Snia of Italy and the Glanzstoff Konzern of Germany. Then the Belgian Tubize and the French Comptoir joined the combine,[57] thus bringing the whole European rayon industry under a unified organized direction.

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[53] Cahill, *Report on the Economic and Industrial Conditions in France*, 1925, p. 117.

[54] *Ibid.*, pp. 119 and 121.

[55] Edward T. Pickard, *Commerce Report*, American Embassy, Paris, March 8, 1926.

The post-war development of this branch of manufacture and trade was such as to make comparisons with pre-war years meaningless. Even in the post-war period the changes were so brusque that each year's figures seem to have little in common with those of the preceding year. Up to 1926 the foreign trade figures of rayon yarn show an excess of imports (except 1921, a year of trade depression), which apparently indicates that the demand for this yarn on the part of textile mills exceeded the capacity of national industry to furnish the needed supply. Then in 1926, there was an important excess of exports which presaged the opening of a new era in which France not only satisfied her own requirements but needed to look abroad for new outlets. The international rayon combine will doubtlessly regulate these new currents of international trade:

[56] P. Silven, "L'Industrie de la Soie artificielle," in the *Revue Syndicale de Documentation Économique*, June 1927, pp. 290–298.

[57] Louis Gueneau, "Le Développement des Industries de la Soie artificielle dans le Monde," in the *Bulletin de la Société d'Histoire Moderne*, November 1927, pp. 381–382.

Year	*Rayon yarn trade balance*[58]
1919	−27 metric tons
1920	−53
1921	+81
1922	−143
1923	−555
1924	−1,644
1925	−241
1926	+104

It is quite impossible to tell how much rayon reaches the ultimate French consumer, because the yarn performs a multitude of functions — entering into cotton, woolen and linen weaving for mixtures and effects, into ribbons, passementeries, knitted goods, etc., as well as woven rayon fabrics. The amount of rayon yarn apparently utilized by French industry from year to year may be estimated by subtracting net exports from the domestic production of the yarn:

Year	*Estimates of rayon yarn at the disposal of the French industry*
1919	1,327 metric tons
1920	1,553
1921	1,919
1922	3,143
1923	4,055
1924	7,644
1925	8,242
1926	9,896

Obviously it was the growth of the elaborative rayon industries which brought about the vast and rapid development of the basic chemical industry producing the raw material.[59] The elaborative branches of manufacture, in turn, owed their prosperity to the ever increasing demand for manufactured rayon goods; and this demand, so far as may be estimated, was essentially domestic:

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[58] For data, see *Stat. Mens. Com. Ext.* Plus signs denote excess of exports, minus signs excess of imports.

[59] See note 59 on next page.

Year	Estimated Production of Artificial Silk Fabric[60]	Apparent Domestic Consumption[61]	Ratio of Domestic Consumption to Production
1920	1,475 metric tons	1,467 metric tons	99%
1921	1,823	1,711	93
1922	2,986	2,927	98
1923	3,852	3,742	97
1924	7,262	6,717	92
1925	7,832	7,008	89
1926	9,401	8,554	90

The situation of the rayon industry was thus unique among the principal branches of textile manufacture. The cotton and woolen industries of post-war France were languishing because of a serious decrease in domestic demand. The good fortunes of the natural silk industry after the war were, after all, built upon perilous foundations, foreign demand stimulated by monetary exchange conditions. The rayon industry alone prospered unequivocally in response to an expanding domestic market.

Why, then, was rayon singled out for special favor? While the prices of other textiles in France were soaring to unprecedented

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[59]

Year	Index Number of Rayon Yarn Production	Index Number of Rayon Yarn at the Disposal of French Industry
1919	100	100
1920	115	117
1921	154	145
1922	231	232
1923	259	306
1924	452	572
1925	616	622
1926	769	746

[60] Estimated by deducting 5 per cent for waste from amount of rayon yarn at disposal of French industry.

[61] Domestic consumption computed by deducting net exports from estimated production. For statistics on exports, see *Stat. Mens. Com. Ext.*

heights, rayon remained cheap as compared with natural fibers, and relatively stable in price even during monetary crises.[62] Moreover, the quality of rayon was being constantly improved. Its old defects, non-resistance to moisture, inflammability, non-washability, crude metallic sheen, etc., were one by one eradicated. The greater part of the swelling demand came from the poorer, but at the same time more numerous, classes of society, who found in this substance the satisfaction of their craving for luxury.

Perhaps, also, the bowing of the older textile industries of France before the whirlwind of rayon presages an approaching upheaval of universal significance in textile manufacture. It is always extremely hazardous to peer into the future. Still, may it not be that chemical fibers will one day replace natural fibers almost completely, thus rescuing the early stages of textile production from the caprice of weather and other natural exigencies? This would not only bring the primary textile processes under the more perfect control of man, but by industrializing them would create conditions of production more in harmony with changing social and economic demands.

[62] Page 366, note 41.

CHAPTER XV

THE CHEMICAL INDUSTRY

That branch of manufacture which is generally designated as the chemical industry is too wide, too varied and too protean, under conditions of modern technical progress, to be susceptible of any comprehensive definition. The French census includes under the heading "*industries chimiques*" not only the fabrication of chemicals properly speaking, i.e. acids, bases, salts, dyestuffs, oils, soaps, synthetic fertilizers, etc., but also tobacco curing, match manufacturing, and the production of illuminating gas,[1] which in many other countries are not placed in the same category. To be sure, the processes involved in these latter industries are essentially chemical, but that is equally true of all metallurgy, the manufacture of rubber and rayon, and the elaboration of many foodstuffs and beverages, which are nevertheless rarely classified as chemical industries. In the absence of an internationally standardized concept of the term "chemical industries," it is practically impossible to make comparisons of French chemical production taken as a whole with that of other countries.[2] All that can be attempted here is to examine the development of the few key departments of chemical manufacture in France which condition the growth of the entire industry in all its ramifications.

1. Retrospective

The story of the French chemical industry is a curious one. At one time its position in the world was unrivalled, and before 1860 there was no reason to suppose that France would fall far behind and become tributary to other nations for chemical products. This actually happened, however, and only the stimulus of the war and post-war conditions restored her to a more or less autonomous position. The recent post-war renaissance of intensive chemical manufacture in France has often meant the picking up of old threads and the revival of half forgotten traditions.

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[1] *Recensement général de la Population, 1921*, Tome I, Troisième Partie, p. 23.

[2] C. Ungewitter, "Monograph on the Chemical Industry," in the League of Nations, *The Chemical Industry*, pp. 10 and 11.

More than a century ago, France, not unlike Germany in the late war, was blockaded by her enemies and cut off from the supply of many indispensable raw materials for which there were no natural resources in the country. The twenty-three years of war, beginning with the Battle of Valmy in 1792 and closing with the Battle of Waterloo, had put France to the task, not only of exploiting to the utmost the rare chemical industries already in existence, but of inventing and creating entirely new ones. Practically over night thousands upon thousands of French soldiers had to be equipped to fight the invading armies of Prussia and Austria which were coming to quench the fire of revolution. Hitherto unheard-of quantities of rifles, powder, army cloth, shoe and saddle leather, and so on, were required at once, if France was to repel the unwelcome attempts of the rest of Europe to restore the *ancien régime*. The old industrial equipment was clearly inadequate. To fill the gaps, the revolutionary government called the scientists of the time into national service. They transformed laboratory reactions into industrial processes; and under their direction chemical factories sprang up everywhere like mushrooms. New methods of tanning supplied the French armies with leather faster than it had ever been done before. New ways of conserving food — harbingers of modern canning — were invented. Paris alone was soon in a position to turn out over 35,000 pounds of powder a day. The French revolution was saved by the inventive and organizing genius of French chemists.

France's troubles were far from ended when the storms of the Revolution had passed, and the hostile parties from within and from without were finally repelled. The advent of the Napoleonic régime led to a long war, and, what was worse for France, to an intermittent series of blockades cutting her off from England, the chief manufacturing and shipping country of the time. Finding themselves suddenly deprived of the commodities they had been accustomed to import from or through the British Isles, the French learned to manufacture all the then known acids and to extract soda from sea-salt in huge quantities; they invented bleaching processes that were more rapid and cheaper than any known before; they discovered ways of producing synthetic alum, copperas, and ammonium salts. There was, even so long ago, a very interesting evolution in the dyestuffs industry. As cochineal red from Mexico was no longer obtainable in France, it was replaced by the red of the home-grown madder root. Indigo blue, previously imported from the East Indies, was now manufactured from wood cultivated in France. The French also discovered a process for the application of Prussian blue to silk.

The inventions in foodstuffs at that time are reminiscent of the recent German experience. During the Napoleonic wars the French and Belgians learned to substitute roasted chicory for coffee. In view of the difficulty of procuring cane sugar, the French succeeded in applying industrially an old German invention for the manufacture of sugar from beet-root. Even vanilla, a product of West Indian plants, was superseded by an essence extracted from oats and treated with alcohol. One of the most sensational discoveries of the epoch was that of the chemical composition of soap by Darcet in 1807. To quote the historian Pariset: "Before the Revolution, France powdered herself more than she washed. She then produced 24 million francs' worth of powder as against 18 million francs' worth of soap. In 1814, the proportion was reversed: 6 millions of powder and 33 millions of soap."[3] When the wars were over and the famous Count Chaptal was taking stock of the industrial progress made by France from 1789 to 1819, he found that his country was "unrivalled in the chemical arts."[4] He did not exaggerate.

With the splendid start given by such men as Lavoisier, Berthollet, Chaptal and Leblanc, and carried on by scientists of the caliber of Chevreul and Gay-Lussac, France was able to maintain her position of first rank in applied as well as pure chemistry up to the middle of the nineteenth century. During this period, England ran a close second. Soon, however, both rivals were hopelessly outdistanced by a new and hitherto unsuspected power, Germany.

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[3] G. Pariset, *Le Consulat et l'Empire* (Vol. III of Ernest Lavisse, *Histoire de France contemporaine*), p. 278.

[4] Chaptal, *De l'Industrie françoise*, Tome I, p. XLV.

The fall of France from primacy, particularly after 1860, raises a double question. Why did France, in comparison with the rest of the industrial world, cease to make as much progress as in the past? What were the circumstances that gave Germany the lead? Professor Moureu's answer is that French chemists between 1860 and 1890 lost themselves in a lengthy quarrel over theories.[5] For thirty years, the university professors spent their energy in desperately defending the old theory of equivalents against the incursions of the atomic theory championed by mere outsiders. Meanwhile, the German universities were granting complete liberty of discussion in matters of scientific doctrine. There, no experimentation was banished because it ran counter to official theory. The result was that, while French chemists directed their attention exclusively to inorganic chemistry, where theoretical controversies played no part, German chemists proceeded by leaps and bounds to conquer the organic fields. Professor Moureu complains bitterly that during this period the French professor "wrapped himself in a cloak of pure science and looked with utmost disdain upon all practical applications." The German professor, on the contrary, regarded himself as an agent of industry quite as much as of learning.

The general attitude of French academic chemists at the close of the nineteenth century, though closely related to the inferiority of the French chemical industry, can hardly be regarded as solely responsible for that inferiority. The causes lie deeper, and the status of both pure and industrial chemistry in France is the result of the same causal complex.

Germany's bound to the forefront was due largely to a series of international inventions, fortunate for Germany but hardly affecting the conditions of French production. In fact, paradoxical as it may seem, by starting late in the adoption of large-scale production, Germany gained a great advantage over France and England. She was not confronted at every step, as she introduced new machines and the latest manufacturing processes, with the problem of scrapping vast and costly existing plant equipment and of violating myriads of vested rights and customs which encumbered the paths of industrial progress of her western neighbors.

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[5] Charles Moureu, *La Chimie et la Guerre*, pp. 294–298.

The way in which Germany, before the war, attained a practical monopoly in the synthetic dye industry (a branch of the organic chemical industry), is as illustrative of the peculiar historical obstacles which prevented other countries from keeping pace, as it is of Germany's genius. About 1860, the new-born German textile industry saw all possibility of expansion blocked by the difficulty of obtaining the necessary dyestuffs. Germany had to pay heavy tribute to England for indigo from India, and to France for madder root from the south. Little wonder that she seized upon Perkins' invention of aniline mauve (1856) and Verguin's invention of fuchsine (1856). England and France, the countries where these synthetic dyes were first discovered, neglected to utilize them because they themselves were so well provided with "natural dyes."

Germany's dependence on foreign sources for raw dyestuffs was not at first alleviated by this early introduction of synthetic processes. She still had to go to England for her coal-tar from which mauve, fuchsine and alizarine were derived. In 1887, a new source of the crude chemicals (benzene, naphthalene, anthracene, phenol and toluene) required for the manufacture of synthetic dyes, was discovered when Franz Brunck came forward with a process for recuperating these products from coke-oven gases.[6] Were it not for an invention in another field, Brunck's discovery might have been of no practical value. What would have been the use of going to the expensive trouble of distilling a ton of coal only to obtain about 20 pounds of crude chemicals, as a by-product, if the principal product, coke, could find no other outlet than the waste pile? Luckily, just about this time, the Thomas process for converting phosphoric iron into steel was being widely adopted in Germany. Lorraine iron ore, hitherto useless because of its high phosphorous content, now became good food for German blast furnaces which called for ever increasing quantities of metallurgical coke. Thus, Ruhr coal was married to Lorraine ore, and in the coking of the coal, the crude chemical products wanted by the synthetic dye industry were produced on a large scale and very cheaply.

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[6] Émile Krumme, *L'Industrie des Matières colorantes aux États-Unis et en Allemagne*, p. 11.

At the opening of the twentieth century, England and France woke up to find their smug contentedness with natural dyes disturbed. The less costly and more easily manipulated coal-tar dyes had conquered the world. Madder root, once cultivated over 50,000 acres in southern France, was routed by German synthetic alizarine, and the French peasants were driven to sow their fields with China grass to save themselves from ruin. The vast region of Madras, whose prosperity in the nineteenth century was built on the indigo plant, fell from plenty into want when the Germans succeeded in 1897 in obtaining artificial indigo from toluene on a commercial scale.[7] India had exported indigo in 1896 to the value of over $15,000,000; in 1913, her exports of this dye were worth about $300,000, while the German exports were valued at about $10,000,000.

It seems clear then that France lost her supremacy in the chemical industry to Germany, not merely because French professors were too busy quarreling about theories to make practical inventions, nor because French savants took the noble vow of poverty and devoted themselves exclusively to science for science's sake. The reasons lie rather in a peculiar concurrence of circumstances which were determined by the economic, social, industrial, and even geological history of both countries. Not least among these reasons is the material fact that France, with coal reserves only one twenty-fifth the size of Germany's, was in no position to build a rival industry based on the distillation of coal.

The Pre-War French Chemical Industry

The manufacture of coal-tar colors and other organic chemical products, such as synthetic perfumes, photographic developers, synthetic drugs, etc., does not by any means constitute the whole of the chemical industry. By definition, the *organic* branch of chemistry includes only substances of which carbon forms an integral part. Outside of this organic field, there is an immense number of *inorganic* or non-carbon substances. In fact, the whole of what is termed the "heavy" chemical industry is concerned with the production of some of these chemical compounds containing no carbon. How vastly important the inorganic branch is can be gathered from the mere enumeration of a few of the principal products: sulphuric acid, nitric acid, hydrochloric acid, soda, potash, mineral salts, superphosphates — not to mention chemicals of metallurgical and electro-chemical origin.

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[7] *Ibid.*, p. 15.

Except for the production of potash, liquid chlorine, bromine, and sodium nitrates, the French inorganic chemical industry was in a most flourishing condition before the war.[8] France and her colonies possessed adequate plant capacity to answer her own requirements for "heavy" chemicals. That, at least, is the impression given by the *Rapport général sur l'Industrie française*, published in 1919 by the Ministry of Commerce. Though the production statistics in the Report are notoriously untrustworthy, it is probable that the general conclusions are correct, especially as they are confirmed by the foreign trade figures. There was on the eve of the war an excess of exports over imports of such fundamental chemicals as calcium carbide, nitric acid, sodium chloride, other sodium compounds, chloride of lime and superphosphates. This list does not exhaust the gamut of French pre-war production, for there are many chemicals, like sulphuric acid, which play practically no part at all in foreign commerce, because they are so difficult to transport. Nevertheless, these products would certainly rank very high in production statistics, were such statistics available.

Though it is not possible to draw a picture of the French chemical industry on the eve of the war with any precision, still a fair notion of its status may be obtained by correlating whatever scattered scraps of reliable information there are. In so far as the volume of foreign trade in chemicals indicates anything as to the productive ability of the industry, it appears from the following table that while the French production was far from attaining the colossal proportions realized elsewhere, yet the manufacture of chemicals was established on a scale which corresponded with the needs of the country and even yielded a moderate export surplus:

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[8] Moureu, *op. cit.*, p. 5.

FOREIGN TRADE IN CHEMICAL PRODUCTS, 1913[9]

(In thousands of dollars)

Country	Exports	Imports
Germany	199,703	90,287
England	95,906	73,999
United States	45,853	119,744
France	70,193	55,668
Italy	16,638	35,020

Pre-war France, unlike Germany, had no world monopoly in organic chemicals to swell her export figures, nor did she enjoy, as did the United States, any period of tremendous expansion in other branches of industry requiring the importation of huge quantities of foreign chemicals. The relation between exports and imports in France resembled very much that in England. As the French like to put it, the scope of their chemical industry was restricted to the production of those substances which could be manufactured under the most favorable circumstances, especially with respect to cost.

The glamour of the German organic chemical industry before the war was such as to blind the world to the progress made in other countries. M. Duchemin, president of the *Union des Industries Chimiques*, has shown very strikingly that French production was indeed far from negligible — even in comparison with the accomplishments of the principal industrial countries. He gives (unfortunately without citing the source of his information) the following table (see next page) showing the per capita consumption of the principal heavy chemicals.

It will be noted that in the case of the first four products, French consumption per capita exceeded that of Germany and of the United States, although it fell behind that of England, except for the superphosphates. French foreign trade in sulphuric acid, sodium compounds (except nitrates), superphosphates and chloride of lime was either insignificant in comparison with the amounts consumed,

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[9] Ministère du Commerce, *Rapport sur l'Industrie française*, Vol. II, p. 4.

PER CAPITA CONSUMPTION OF HEAVY CHEMICALS[10]
(In kilograms)

Chemical	France	Germany	England	U. S.
Sulphuric Acid.......	25.00	23.00	27.00	22.00
Sodium Compounds...	8.25	7.85	16.30	6.75
Superphosphates.....	48.00	26.00	19.00	32.48
Chloride of Lime.....	1.10	1.00	2.67	.90
Ammonium Sulphate..	1.70	7.85	10.00	1.55
Cyanamid..........	.187	.493	.....	.64

or else resulted in a distinct excess of exports. The imports of superphosphates for 1910–1913 averaged 244,487 metric tons per year, while the average annual exports for the same period amounted to 528,889 metric tons.[11] This would indicate that for these chemicals at least, France had a productive capacity sufficient to supply her own needs.

When it is remembered that the fifth chemical on the above list, ammonium sulphate, is a product of the distillation of coal, then the contrast between the German and French figures comes with no surprise in view of the relative penury of French coal resources. In fact, though the French consumption per capita of ammonium sulphate was less than a fourth that of Germany and little more than a sixth that of England, France was obliged to import an average of 22,507 metric tons per year during the four years preceding the war. Such was the tyranny exercised by the want of adequate coal resources. As for the last chemical in the list, the low consumption per capita is attributed by chemical manufacturers to the obstinate conservatism of the French peasant who would not buy this new fertilizer. It may very well be that the peasant refused cyanamid because he was routine-ridden, but he did not necessarily act unwisely. The Department of Agriculture of the United States (Bulletin 1180, 1924) found that the use of this fertilizer is very hazardous, for it is not suited to sandy, clayey or acid soils — leaving indeed very few soils for which it is of value. Nevertheless, even for the small and hesitant pre-war consumption of cyanamid (about 8,000 tons), French production did not suffice. Approximately 500 tons had to be imported in 1913.

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[10] R. P. Duchemin, "L'Industrie chimique française," *Bulletin de l'Union des Industries Chimiques*, March 1925, p. 74.

[11] All import and export figures in this chapter indicate gross weight.

The relatively high per capita consumption of sulphuric acid (if M. Duchemin's figures are correct) is of great significance as an index of productive activity, not only in the chemical industry, but in the whole of French industry. If sulphuric acid is not generally mentioned in the same breath with coal and iron as constituting one of the pillars of modern industrial civilization, it is only because its rôle is not so obvious to the layman and not because it is less indispensable. There is hardly a branch of manufacturing in existence in which a chemical process does not intervene at some point or other; and very rare indeed are the industrial chemical reactions in which sulphuric acid does not play an essential part. Not only is sulphuric acid used in the current processes of manufacturing soda and hydrochloric acid, but also in the production of nitric acid and explosives. The extraordinary development of the manufacture of sulphuric acid in England in the last century was due to the great demand for soda and bleaching-powder to supply the rapidly expanding soap and cotton industries. Even the organic chemical industry requires sulphuric acid in the fabrication of coal-tar dyes, drugs, etc. It enters into metallurgy and oil refining. In France by far the greater part of sulphuric acid consumed is absorbed in the manufacture of superphosphates — the most important of artificial fertilizers.

While in the United States sulphuric acid is to a large extent derived from native sulphur, in France, where no sulphur deposits exist, the principal raw material has consisted since 1833 of iron pyrites. The pyrites are roasted in special ovens until their sulphur is oxidized, thus producing sulphurous acid gas, which is in turn oxidized in leaden chambers in the presence of nitric acid. The product of the second oxidation is absorbed by water, giving sulphuric acid. This so-called "chamber process," except for improvements in detail, dates from the middle of the eighteenth century and is still the predominant method in France. As far back as 1831, it was observed that sulphurous acid gas is oxidizable in the presence of finely divided platinum without the use of clumsy leaden chambers and nitric acid. It was not, however, until the beginning of the present century that the "contact process" was sufficiently perfected to be used for the commercial production of highly concentrated sulphuric acid.

Though up to the present the contact process has been found more costly than the chamber process, the advantage of the former lies in the fact that it is, so to speak, more elastic. The chamber process is cumbersome, involving heavy investments and huge plant equipment; obviously, it cannot respond with any rapidity to fluctuations in demand. A product like sulphuric acid, the uses of which are so infinitely varied and multitudinous that any prediction as to future demand is practically impossible, requires a process utilizing inexpensive industrial apparatus which can be easily multiplied or cut down in accordance with changing market and technical conditions. The contact process comes nearer to fulfilling this condition than any other, but as the French cost of production of contact acid is 20 per cent greater than that of chamber acid, the search continues for something still better.[12]

The French pre-war production of sulphuric acid has been estimated at about 1,200,000 tons, of which only 0.5 per cent was produced by the contact process. At the same epoch, Germany was producing 24 per cent of her sulphuric acid by the more recent method. French production was not, however, conducted on a small scale. Over 60 per cent of the sulphuric acid manufactured in France was produced by a few large firms such as the *Établissements de Saint-Gobain*, and the *Établissements Kuhlmann* (a purely French concern). In 1913, France possessed 87 sulphuric acid plants, over 75 per cent of whose output was absorbed in the making of superphosphates. The remainder was utilized principally in the manufacture of sulphate of copper and sulphate of ammonia, and for the pickling of metallurgical products.

As the following table indicates, domestic production did not quite suffice — but the importance of these net imports must not be exaggerated, since they never amounted to more than a fraction of 1 per cent of French consumption:

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[12] L. Pierron, "Acide sulphurique," in *Chimie et Industrie*, Vol. I, p. 373.

Pre-war net imports of sulphuric acid

1910	9,495 metric tons
1911	10,047 " "
1912	8,952 " "
1913	6,391 " "

More than 98 per cent of the imports came from Belgium and Germany. In view of the non-transportability of sulphuric acid, they are obviously part of the short-haul movement of goods in the northern and eastern industrial frontier regions, where national boundaries, interposing incongruous tariff barriers, are economic anomalies — for all their political *raison d'être.*

Next in importance to sulphuric acid from the industrial point of view is nitric acid. Its rôle in the manufacture of sulphuric acid has already been described. It is used also in both organic and inorganic industrial chemical processes, in engraving and dyeing, in the fabrication of nitroglycerine, gun-cotton, celluloid, oxalic acid, synthetic dyestuffs, artificial silk, etc. Very often it appears in industrial reactions as an inseparable partner of sulphuric acid. There is no way of estimating the pre-war world consumption of nitric acid. It is said that in 1913 France consumed about 18,000 tons, of which 6,000 tons were absorbed by the State powder works. There is no doubt, as the following table of net exports clearly indicates, that the French production of this basic chemical intermediate sufficed for all home needs:

Year	*Net exports of nitric acid*
1910	−705 metric tons (import excess)
1911	+514 " " (export excess)
1912	+634 " " " "
1913	+1,741 " " " "

Before the war the only important source of nitrogen for the manufacture of nitric acid was nitrate of soda; and practically the only source of nitrate of soda was Chile. The whole world depended on that country for its nitrogen supply, whether it was destined for the manufacture of nitric acid, for fertilizer or any other purposes. France, as the following table shows, held third place in the consumption of Chilean nitrates.

IMPORTS OF CHILEAN NITRATES, 1913[13]

Country	Quantity (In tons)	Percentage
Germany	835,000	32.7
United States	590,000	23.1
France	322,000	12.6
Belgium	318,000	12.4
Holland	203,000	7.9
Great Britain	130,000	5.1
Italy	50,000	1.9
Egypt	25,000	1.0
Spain	15,000	0.6
Other countries	67,000	2.7
Total	2,555,000	100.0

The surprisingly large figures for Belgium and Holland are explained by the fact that part of these imports went eventually into Germany. Of the French imports, about 89 per cent was used as fertilizer, and approximately 5 per cent was taken up by powder works, leaving only 6 per cent for the manufacture of nitric acid and other chemicals.

The current pre-war method of producing nitric acid consisted of two phases: the decomposition of nitrate of soda by sulphuric acid, and the condensation of the resulting nitric acid vapors. The first reaction could take place only with the aid of slow heating, which implies that, in addition to nitrates and sulphuric acid, no small amount of coal was needed. In order to produce one ton of nitric acid, 900 kilograms of nitrate, 950 kilograms of sulphuric acid and 400 kilograms of coal were consumed. It is true that on the eve of the war Norway had developed on an industrial scale the manufacture of nitrates and nitric acid by the direct combustion of atmospheric nitrogen, and that Germany was rapidly evolving a cheap way of oxidizing ammonia to produce the same substance, thus in both cases dispensing with Chilean nitrates. These newer processes did not take any perceptible hold on France until the war was in progress.

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[13] Ministère du Commerce, *Rapport sur l'Industrie française*, 1919, Vol. II, p. 36.

Hydrochloric, otherwise known as muriatic, acid completes the trilogy of fundamental acids. Its uses are no less numerous than those of the acids already discussed; it is employed notably in the manufacture of ammonium salts, gelatine, chlorine and dyestuffs, in the extraction of phosphoric acid from bones, and in the iron, copper and zinc industries. Here again no data exist for comparing French consumption with that of other countries. It has been estimated that the production of hydrochloric acid in France in 1913 attained a figure between 125,000 and 150,000 tons, which was distributed among fourteen factories, seven of them in the département of the Nord, and the rest scattered in the west, the south, and the Lyons region. The united efforts of all these plants however did not quite suffice, for during the four years preceding the war, the net imports averaged about 1,800 tons per year.

An interesting illustration of the close concatenation of the various parts of the chemical industry is seen in the way in which the volume of production of hydrochloric acid varies with the quantity of sodium sulphate manufactured and in the way in which the production of this latter substance fluctuates in turn with the activity of glass works. Since hydrochloric acid is generally manufactured in conjunction with sodium sulphate and sodium carbonate, the process will be described in the following discussion of soda, which will be the last of the inorganic chemicals treated for the purpose of determining the state of the French chemical industry on the eve of the war. Enough has already been said to indicate that the rate of production of a few fundamental products determines the tempo and capacity of the whole chemical industry. It would therefore be tedious and superfluous to attempt a separate description of each of the innumerable branches of this highly complex field of production.

Coal, petroleum, sulphuric acid and nitrogenous products have become so intimately woven into the very warp and woof of modern everyday existence that it is difficult to conceive of a time when for all practical purposes not one of them existed. And yet it is only quite recently that they have come one by one into the domain of man's control and use. Sodium compounds, on the contrary, whether in the form of sodium chloride (common salt), sodium carbonate (soda), or sodium sulphate ("salt cake"), had been known and utilized even before the historian began to lift the veil of the past. The present day uses of the most important of sodium compounds, sodium carbonate (commonly called soda), are no less numerous than those of the acids considered above. Wherever soap, enamel, glass, and paper are made, wherever textiles are finished, dyed, and bleached, wherever borax, caustic soda, and other sodium compounds are manufactured, and in other innumerable industrial chemical reactions, soda enters as a basic intermediate. No small proportion of soda finds its way into the household kitchen.

France is the cradle of the modern soda industry. In 1791, a French chemist, Leblanc, responded to the call for cheaper and more abundant soda required for glass and soap factories. Sunlight and cleanliness ceased to be expensive luxuries, thanks to the Leblanc process, by which common salt was decomposed with the aid of sulphuric acid, and the resulting sodium sulphate was fused with limestone and coal to be then treated with water in order to extract the sodium carbonate. At first, the hydrochloric acid gas which was given off during the first phase of the process was allowed to escape into the air, with deleterious effects on vegetation and building materials in the neighborhood of the works. Public authorities in compelling an abatement of this intolerable nuisance unwittingly performed a notable service for the Leblanc soda manufacturers. To be sure, the latter were forced to put up costly apparatus for bringing the hydrochloric acid gas into contact with water which absorbs it greedily; and thus hydrochloric acid was produced in greater quantities than they at first knew what to do with. But gradually more and more of its valuable uses became known. Now that the Leblanc process has been to a large extent superseded by newer and better ways of producing soda, the old 1791 method still persists for producing the intermediate sulphate of soda, and — what was formerly a noxious waste product — hydrochloric acid.

In 1863 the Solvay brothers set up their first little plant near Brussels, and began a courageous struggle in the face of untold difficulties to make their new soda process an industrial success.

In this way a blow was dealt to the Leblanc process. The Solvay process consists in taking a purified solution of ordinary salt in water and saturating it with ammonia, then in passing carbon dioxide gas through the solution, with the result that sodium bicarbonate crystals are precipitated. Finally the crystals are heated, giving off carbon dioxide and leaving soda. The superiority of this method lies in the fact that most of the ammonia and carbon dioxide is recovered and used again. The fuel required is only half that consumed in the Leblanc process and the labor costs are also lower. Still, the Leblanc process survives for several reasons. It is, as has just been seen, the predominant way of manufacturing hydrochloric acid and sodium sulphate. In the Solvay reactions, all the chlorine is lost in the shape of the practically worthless calcium chloride. It has been found also that Leblanc soda is more readily converted into caustic soda (sodium hydroxide). Were it not for these advantages and for the increased use of sodium sulphate by glass works, the Leblanc process might long ago have been consigned into the limbo of the past.

Though one-third of the world's soda is still produced by a more or less modified Leblanc process,[14] in France today the old order has passed away completely. The table on page 435 shows strikingly the rapidity with which the change has taken place. This technical revolution has been more thoroughgoing in France than in England or Germany, to a large extent because France, being less industrialized at the close of the last century, has been less burdened by plant equipment of the older type.

The essential raw material at the basis of all three soda processes is sodium chloride, that is, common salt. Rare indeed are the countries where this substance is not found in great abundance. France is richly endowed with rock salt deposits, particularly in the east and in the southwest. The salt is mined from beds of extinct salt lakes buried deep under the ground by the age-long movement of the restless earth crust. Important quantities of

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[14] It has been estimated that in 1924 the world production of soda amounted to 3,100,000 tons of which less than 1,000,000 tons were fabricated by the Leblanc process. Jehan H. Lucas, "La Soude, le Sel et l'Ammoniaque," in *Chimie et Industrie*, Vol. I, p. 1246.

PRODUCTION OF SODA IN FRANCE[15]
(In tons)

Year	Leblanc Process	Solvay Process	Electrolytic Process
1853	45,000	....	......
1874	56,000	17,000	......
1883	50,000	44,000	......
1893	27,000	120,000	......
1899	20,000	195,000	2,000
1905	6,000	270,000	4,000
1913	900	366,000	5,000
1924	......	464,000	20,000

salt are derived, too, from the evaporation of salt water by solar heat in the salt works on the southeast and southwest seaboards of France, where the climate is dry and the summers long. France exported before the war as much salt as she imported.

The ammonia used in the Solvay process is derived either as a by-product in the distillation of coal or in connection with the synthetic nitrogen and nitrate fertilizer industries which will be treated in the post-war section of this chapter. As little ammonia is lost in the course of the Solvay operations, and most of it is reutilized, the constant need of ammonia for this purpose is not proportional to the quantity of soda produced. This fact has been of considerable influence also in the geographic distribution of soda works. Unlike the Leblanc soda factories, which were situated in the industrial centers of the north and the south of France near the source of sulphuric acid, the Solvay plants tended to be situated in the east and south, close to the salt mines and salt marshes. Each new development of the electrolytic process will bring the manufacture of soda nearer to the hydro-electric power plants of the Alps and the Pyrenees.

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[15] The data for the years 1853 to 1913 were taken from "La Grande Industrie chimique en France," article signed XXX in *L'Illustration Économique Financière*, Dec. 11, 1926, p. 78. The total for 1924 was taken from Jehan H. Lucas, *op. cit.*, p. 1247, and the amount produced by the electrolytic process in 1924 from V. Barut, "L'Électro-chimie et l'Électro-métallurgie," in *Chimie et Industrie*, Vol. I, p. 1268.

Before the war, France produced not only enough soda to satisfy her own requirements, but also an important surplus for exportation. French production of this chemical in 1913 has been estimated at about 372,000 tons. The average annual net exports during the four years that immediately preceded the war amounted to 80,752 tons. In spite of these facts, the French lament that they have no national soda industry. The fact is that the Solvay patents and most of the soda works in France are owned by Solvay et Cie., a Belgian firm. France in this respect is no worse off than her neighbors, for the tentacles of Solvay et Cie. reach into Germany, Austria, England, and even the United States. On the eve of the war, the greater part of French soda was produced by this Belgian firm in two factories, one at Dombasle in the rock salt region not far from Nancy, and the other at Salin-de-Giraud on the Mediterranean. Besides these, there were a few soda works belonging to the Société de Saint-Gobain and to the Société Marcheville-Daguin et Cie. The manufacture of soda before the war was concentrated in the hands of a few large firms.

The high degree of organization found in the pre-war soda industry was not characteristic of the whole French chemical industry, even though France was self-sufficient in respect of heavy chemicals. In this connection, it is interesting to turn to the so-called Ludendorf inventory of French industry in the invaded territory, made in 1916 when the Germans held the north of France.[16] The general statements, though requiring to be discounted in view of the circumstances under which they were written, are most instructive. The German experts emphasize the backwardness of French methods in contrast with their own industrial technique. They point for example to the waste involved in the extensive use of wheelbarrows, instead of mechanical devices for transportation within the factory. Wherever they find more advanced technique they attribute it generally to the wide-spread use of machinery made in Germany, to German methods, and even to German personal direction. "The [French] chemical industry," they say, "suffers from the fact that it allows itself to be pushed by competition

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[16] *L'Industrie en France occupée* (*ouvrage établi par le grand quartier général allemand en 1916 — traduction intégrale*), pp. 170–192.

— probably German competition — rather than develop spontaneously."

From time to time, however, these none too friendly experts are found paying tribute to the ingenuity of French methods and organization, particularly in the sulphuric acid and wool-scouring plants. It remained for the post-war period to reveal further unsuspected potentialities of French chemists and manufacturers. In 1916, in view of the powerful economic and technological position which Germany had held for several decades in the organic chemical industry, the expert investigators naturally regarded the French situation in respect of synthetic dyestuffs and pharmaceutical products as hopeless. What surprises the future held in store will be part of the following story of the French chemical industry since the war.

2. The Post-War French Chemical Industry

The profound changes which came over the French chemical industry as a result of the outbreak of hostilities in 1914, the astonishing display of energy in the adaptation of that industry to fighting conditions, the maintenance of a high degree of national productivity in spite of the occupation by the enemy of the most important chemical factories in northern France, the building up almost over night of new and vast branches of the chemical armament industry, all these events have often been commented upon. With the coming of peace many industries that had sprung up in view of the extraordinary war demand came to a sudden standstill and passed away as if they had never been. Some, nevertheless, continued. In the following study of the development of the chemical industry in France since 1919, the war will be taken into account only in so far as it has left any presumably lasting imprints on the broader evolution of the industry. The war having been literally a world war, its myriad industrial consequences were felt in each country, not only directly, but also as repercussions of the fundamental changes wrought in the economic life of the rest of the world. It is important, therefore, to touch on the technical, political, monetary and industrial aspects of these universal changes before entering upon a discussion of the particular situation of the chemical industry in post-war France.

However disastrous the effects of the war may have been on the movement toward increased material comfort which was under way in Europe before 1914, it is a patent fact that the progress of certain industries was accelerated under the stress and strain of international strife. In the pre-war days, the chemical industry was very slow to adopt synthetic processes by which complex substances were fabricated out of simple elements extracted from air, water, and coal. The synthetic products, generally manufactured under very expensive conditions at that time, could rarely compete with chemicals of the same composition found ready-made in nature, even though far away from the place where they were wanted. The outbreak of hostilities, however, suddenly raised insurmountable obstacles between industrial nations and their accustomed sources of raw materials. France could no longer obtain German potash salts; Germany was cut off from French bauxite and Spanish pyrites; the Central Powers had no access at all to Chilean nitrates, which only reached the rest of Europe with great difficulty and in insufficient quantities owing to the submarine danger and to the chaotic state of sea traffic. Under such circumstances it was inevitable that the missing chemicals should be supplied, wherever possible, by synthetic processes.

The manufacture of chemicals out of the elements of air, water and coal, which began principally in Germany during the period of war isolation, was extended during the post-war period. The reasons for this are many and varied. In some instances the synthetic process was perfected so that its product became cheaper than the natural one. In other cases, countries fostered the development of the synthetic chemical industry because they considered their military security imperilled by dependence on foreign sources for raw materials vitally necessary for armaments. Furthermore, no industrial nation wished to be caught napping again, as were England, France, and the United States when Germany built up her synthetic dye industry at the close of the nineteenth century.

It would be difficult to overestimate the importance of this technical revolution for the chemical industry of the whole world. The fact that certain countries were obliged to abandon the well beaten paths that led to distant deposits of raw materials before the war, meant that natural resources, thanks to synthetic chemistry, were becoming generalized. Air was the new source of the nitrogen and oxygen wanted for industrial chemical reactions. What country is without air? Water was the new source of hydrogen which, combined with nitrogen, formed synthetic ammonia. And what country is without water? Coal had long been known as the source of many chemicals for synthetic compounds. But coal was rather unequally distributed in the earth's sub-soil. Some countries, owing to a complete absence or an insufficiency of coal deposits, were still unavoidably dependent on their more fortunate neighbors. Nevertheless, by and large, the old principle of the geographic distribution of the chemical industry on the basis of easy access to natural resources was profoundly altered.

The world's chemical industry was affected also by the transformation of the political map of Europe in 1919. Vast empires, whose economic counterparts consisted of extensive markets undivided by tariff barriers, had been destroyed. In their place were found after the war a multitude of small nations, each aspiring not only to cultural autonomy but also to economic and industrial self-sufficiency. To this ambitious program was joined the guiding principle of military security which demanded that each country should be completely independent of the rest of the world for its supply of materials likely to be needed in time of war. Every nation, new and old, strove to build up, under the protection of high tariff walls, modern, large-scale chemical plants capable of furnishing on demand great supplies of explosives, poison gas, drugs, etc. Thus was blocked many an outlet through which the surplus products of the older industrial centers used to pass. The pre-war consuming market was further narrowed by political events in Russia and China which left these two immense countries in no position to purchase from the West enormous quantities of chemicals, as formerly they had done.

The trade currents of chemicals, as of other goods, were not unaffected by the unstable monetary situation of Europe during the post-war period. As the value of the currency of a given nation declined, it became increasingly difficult for that nation to purchase goods from countries whose money had depreciated less or not at all with respect to gold. On the other hand a falling currency generally stimulated exportation and industrial activity. This is a fact to be borne carefully in mind in view of the rapid growth of the chemical industry in France from 1923 to 1927, for it raises the question as to how much of this expansion is simply an ephemeral reaction to monetary fluctuations, and how much is of a more permanent nature. The rise and fall of currencies which characterized different European countries at different times has led to commercial and industrial upheavals now propitious, now disastrous, now pouring masses of merchandise out over the frontier into other countries, now beckoning for goods from abroad.

This precarious state of affairs was aggravated by the fact that the world was slow to scrap much of the industrial plant equipment constructed for the purpose of filling war orders. When the fighting was over, most manufacturers in neutral and in belligerent countries thought they would be spared in the post-war economic readjustment. Each waited for the other to shut down. The economic crisis of 1921 came about in large measure as a result of this state of affairs and swept many hesitant laggards off their feet. But the dismantling of factories did not keep pace with juridical liquidation which in reality merely transferred the industrial plants from debtor to creditor. The result was that even after the 1921 crisis the productive capacity of various countries was in excess of world demand, especially in the case of certain chemical industries. For example, as regards dyestuffs, it has been estimated that in 1924 the world output represented only 36 per cent of production capacity.[17] In France alone, the plant capacity for producing sulphuric acid doubled from 1913 to 1924,[18] but in the latter year less than two-thirds of this capacity was utilized.

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[17] "Monograph on the Chemical Industry," prepared by the Association of British Chemical Manufacturers, published in the League of Nations, *The Chemical Industry*, p. 85. According to Dr. Ungewitter, *op. cit.*, p. 29, the proportion was 56 per cent.

[18] Production in 1913 amounted to 1,200,000 tons, and in 1924 to 1,530,000 tons, but the capacity had meanwhile risen to 2,400,000 tons. *Cf.* Emile Lambert, "Les

Post-war Europe presented the spectacle of a large number of nations, each endeavoring to erect a chemical industry comparable with that of pre-war Germany but lacking an adequate market to absorb the products. Whatever international economic interdependence existed before the war was largely destroyed. Such was the distressing economic situation to which the French chemical industry was trying to adjust itself.

It is quite as impossible to attain any degree of precision in describing quantitatively French chemical production since the war as it was before 1914. Trustworthy statistics cannot be obtained because most firms withhold from the public any information as to the extent of their activity. Thus not only are industrial processes, especially in their detail, kept under the cover of secrecy, but the scale of production as well. In France it is a respectable and time-honored tradition to keep hermetically sealed any information likely to assist tax officials in confirming declarations or in making assessments. There are also commercial reasons for this unwillingness to publish production figures. The fear that competitors may capture custom is ever present in the minds of captains of industry. Even when taken collectively in their various associations and organizations, manufacturers generally adhere to the tenet of secrecy with regard to their combined volume of production. They suspect that if buyers know the quantity of a given commodity offered, the latter will enjoy a bargaining advantage. As sellers they feel that it is to their profit to keep the buying market ignorant.

In the absence of any reliable production figures, foreign trade statistics must be resorted to as the next best index of industrial activity. The significance of the figures given on page 442 is enhanced by the fact that imports were maintained steadily below the pre-war level at the same time that exports more than doubled. It is evident that the French chemical industry, taken as a whole, was becoming definitely and notably an exporting industry for a world market.

The statistics of foreign trade measured in value rather than in

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Grands Acides minéraux," in *Chimie et Industrie*, Vol. I, p. 1239. M. Lambert does not indicate the percentage of concentration of the acid in his estimate.

Year	Exports and Imports of Basic Chemical Products[19] (In thousands of tons)		
	Exports	Imports	Net Exports
1910	1,033	917	116
1911	1,067	884	183
1912	1,029	979	50
1913	1,118	1,054	64
1919	402	479	−77[a]
1920	922	721	201
1921	983	707	276
1922	1,554	620	934
1923	1,649	805	844
1924	2,123	835	1,288
1925	2,389	807	1,582
1926	2,563	767	1,796
1927	2,847	838	2,009

[a] Excess of imports.

weight show even more clearly the importance of the post-war expansion of the French chemical industry. Before the war the trade balance of France, in so far as chemicals were concerned, tended to be unfavorable. Despite the fact that the exports of basic chemicals exceeded imports in weight by 104 thousand tons per year on the average during 1910–1913, imports exceeded exports in value by about 24 million francs per year at that time. This was probably a consequence of the dependence of France on other countries, especially Germany, for organic products. During the post-war period there was an unmistakable tendency in the direction of a favorable balance:

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[19] These foreign trade statistics include the items designated in the *Statistique Mensuelle du Commerce Extérieure* as follows: 1. Nitrate de soude; 2. sulphate d'ammoniaque brut ou raffiné; 3. sulphate de cuivre; 4. sulphate de magnésie et de potasse; kainite; 5. carbonate de plomb (céruse); 6. potasse et carbonate de potasse; 7. chlorure de potassium; 8. chlorure de sodium; 9. oxide de zinc; 10. produits obtenus directement par la distillation du goudron de houille; 11. tartrate de potasse (lie de vin, etc.); 12. celluloid; 13. engrais phosphatés; 14. autres produits chimiques.

BALANCE OF TRADE IN BASIC CHEMICAL PRODUCTS[20]
(In millions of current paper francs)

YEAR	EXCESS OF IMPORTS	EXCESS OF EXPORTS
1910	...	1
1911	38	...
1912	31	...
1913	26	...
1919	639	...
1920	80	...
1921	91	...
1922	...	72
1923	...	68
1924	...	185
1925	...	146
1926	...	355
1927	...	276

In the above comparisons of pre-war and post-war foreign trade in chemical products no account was taken of territorial modifications of France after 1918. That Alsace-Lorraine contributed very largely to the changed situation is seen in the fact that the imports of potassium chloride fell from 46,138 tons in 1913 to 15 tons in 1926 while exports of this substance rose from 134 tons to 676,033 tons in the same interval. The only source of potassium chloride in France is the sylvinite of the Alsatian mines. According to the 1921 census there were 6,084 persons (exclusive of 8,116 in the potash mines) gainfully occupied in the chemical industry in Alsace-Lorraine, representing 3.2 per cent of the total in the same industry in all France. Because of the automatic nature of a great many processes of chemical manufacture in which little labor is required for a large output, the census statistics show inadequately the real importance of the acquisition of Alsace-Lorraine. In the post-war period the foremost firm for the manufacture of the so-called "light" chemicals was Alsatian, the *Société Alsacienne de Produits Chimiques*, producing an extensive range of organic and inorganic products such as intermediate products (benzene, aniline oils and salts), camphor, hydrocarbides, etc.[21] Moreover, France became a leading producer of basic slag and a close rival of Germany as a consequence of the acquisition of the blast furnaces of Lorraine.

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[20] *Cf. Stat. Mens. Com. Ext.*

PRODUCTION OF BASIC SLAG[22]
(In thousands of tons)

Year	Germany	France
1910	2,007	534
1911	2,160	602
1912	2,475	679
1913	2,500	730
1919	700	203
1920	733	331
1921	953	392
1922	1,179	612
1923	526	585
1924	1,065	945
1925	1,342	1,136

Partly as a result of the war, partly as a result of territorial aggrandisement, and principally as a result of technical progress and of the general expansion of French production, the post-war chemical industry of France was, in practically all its branches, larger, more developed and more powerful than it had ever been before. There was hardly any trace left of the petty plants of pre-war days or of the old submission to the German colossus. The previously existing lines of chemical manufacture were all intensified, and a great many new branches were established in order to furnish products formerly imported. In view of the impossibility of studying this industrial growth *en masse*, the chemical industry will be divided into its three principal component parts: the manufacture of inorganic chemicals; the manufacture of chemical fertilizers; and the manufacture of coal-tar products.

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[21] J. R. Cahill, *Report on the Economic and Industrial Conditions in France, 1925*, pp. 235–236.

[22] *Annuaire Statistique, 1926*, p. 304.

The Post-War French Inorganic Chemical Industry

The important place that sulphuric acid holds not only in the inorganic chemical industry but in all chemical manufacturing has already been described. In fact, before the war the quantity of sulphuric acid produced was regarded as an index of chemical and industrial progress. That was still true for France in the post-war years. The more recent developments in technique which tend to eliminate the direct use of sulphuric acid in the superphosphate, nitric acid, and hydrochloric acid industries[23] may some day deprive this substance of its pivotal rank, but that is a matter of the future.

There was undoubtedly an increase in the French output of sulphuric acid in the post-war period. Some estimates would have it at 66 per cent[24] from 1913 to 1925, others at 28 per cent,[25] and others at 24 per cent.[26] Since by far the greater part of sulphuric acid manufactured in France is derived from iron pyrites, the variations in consumption of this raw material indicate perhaps better than anything else the extent of the development of the French sulphuric acid industry:

Year	Consumption of Iron Pyrites[27] (In thousands of tons)	Percentage of 1910–1913 Consumption
1910–1913 (average)	624	100
1920	375	60
1921	528	85
1922	433	69
1923	640	103
1924	573	92
1925	682	109
1926	706	113

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[23] "Monograph on the Chemical Industry," prepared by the Association of British Chemical Manufacturers, published in the League of Nations, *The Chemical Industry*, pp. 79–80.

[24] *Ibid.*, p. 81.

[25] Emile Lambert, *op. cit.*, p. 1239.

[26] C. Ungewitter, *op. cit.*, p. 23.

[27] Sources: *Annuaire Statistique, 1926*, and *Stat. Mens. Com. Ext.*

It must be remembered that iron pyrites are not the only raw materials yielding sulphur for sulphuric acid, and that therefore the above index is most probably an underestimate. Zinc blend, copper pyrites, and crude sulphur are also used. Ever since the application, at the close of the nineteenth century, of the ingenious Frasch process for the extraction of crude sulphur, this last substance which had originally been the sole raw material, came again into favor. The net average annual imports into France increased from 191 thousand tons for 1910–1913 to 415 thousand for 1923–1926.

The output of nitric acid also increased. According to M. Lambert's estimate, whereas 18,000 tons had been produced in 1913, the production in 1923 amounted to 25,000 tons.[28] The most striking feature of this increase is that it was accompanied by a marked diminution in the net imports of sodium nitrate (Chilean nitrates). During 1910–1913 the average annual net imports of this raw material, which was then the principal source of nitrogen for industrial purposes and fertilizers, amounted to 329 thousand tons, and during 1923–1926 they fell to 260 thousand tons. In view of the fact that the quantity of nitrogenous fertilizers utilized in France increased by about 35 per cent from 1913 to 1924,[29] the diminution in imports of sodium nitrate would indicate a radical change in the technique of manufacturing nitrogenous products in France.

In fact, during the war the German submarines and the consequent disorganization of sea traffic rendered difficult the importation of an adequate supply of nitrates from Chile. Since nitric acid was indispensable to the fabrication of explosives and munitions, the French were compelled to resort to synthetic methods. They set up a plant at Pierrefitte in the Pyrenees for the direct oxidation of nitrogen by means of an electric arc (Birkeland and Eyde process). In the absence of abundant water power to supply the necessary electric current this was found to be too expensive a process. Since it was much cheaper to obtain the nitric acid indirectly by first manufacturing ammonia from calcium cyanimide and then oxidizing the ammonia, it was this latter process which found greater favor in France toward the end of the war. The advantage of both these synthetic methods lay not only in the fact that they partly freed France from dependence on Chilean nitrates, but also that they did not leave a practically useless by-product, bisulphate of soda, as did the old process of decomposing sodium nitrate by means of sulphuric acid.

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[28] E. Lambert, *op. cit.*, p. 1239.

[29] Measured in terms of pure nitrogen. *Cf.* E. Rabaté, "Les Engrais," in *Chimie et Industrie*, Vol. I, p. 1251.

When the war was over the French continued in their effort to manufacture as much of their nitric acid as possible synthetically. It was a matter of commercial necessity because Germany, thanks to the Haber-Bosch process, was able to market nitrogenous products at a lower price than most other countries. It has been calculated that the cost of production of a ton of nitrogen in concentrated nitric acid manufactured by the Haber-Bosch process was at least 40 per cent cheaper than the same nitrogen derived from Chilean nitrates.[30] It was also considered a matter of military necessity that France should be prepared to draw on the limitless supply of nitrogen in the atmosphere to manufacture nitric acid for munitions.

The ease with which nitric acid could be manufactured from ammonia reduced the whole problem of synthetic nitric acid to one of synthetic ammonia. As ammonia and other nitrogenous substances are used in peace time principally as fertilizers, the new processes will be studied in greater detail in the section dealing with this subject. It may be noted here, however, that although there are no statistics showing what per cent of nitric acid was manufactured synthetically in France, progress must have been considerable, for, according to the Ministry of Commerce, the annual capacity of production of synthetic nitrates at the close of the war was 200,000 tons,[31] very probably an exaggerated estimate.

As for hydrochloric acid, it appears that there was a decrease in French production after the war. M. Lambert estimates the French output in 1913 at 140,000 tons and in 1924 at 120,000 tons.[32]

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[30] Michel Samsoen, *Le Régime de l'Industrie de l'Azote en France*, p. 65.

[31] Ministère du Commerce, *Rapport général sur l'Industrie française*, Tome II, p. 42.

[32] E. Lambert, *op. cit.*, p. 1240.

The reasons for this are numerous and highly complex, for hydrochloric acid is practically always manufactured as a by-product in the fabrication of some other substance. In the first place the disappearance of the Leblanc soda process in France cut off a very important source of hydrochloric acid. Then, too, not only did the production of window glass in France decline after the war,[33] thus creating a diminished demand for sodium sulphate, but in the glass production that remained, sodium carbonate tended to replace sodium sulphate. Since hydrochloric acid was produced almost always solely as a sodium sulphate by-product, the decline in the production of this acid was inevitable.

There was not, as might have been expected, any increase in the importation of hydrochloric acid. On the contrary, the post-war foreign trade figures reveal an excess of exports, rather than an excess of imports as was the case before the war:

BALANCE OF TRADE IN HYDROCHLORIC ACID[34]
(In tons)

Year	Net Imports	Net Exports
1910–1913 (average)	1,820	....
1920	777	....
1921	....	922
1922	389	....
1923	....	1,996
1924	....	3,589
1925	....	841
1926	....	503
1927	....	2,146

This means obviously that the demand for hydrochloric acid was smaller in the post-war years than it had been before. In view of its extended use in a great variety of industries, the question arises whether the industries dependent on it were declining too.

The diminished demand for hydrochloric acid was not due to any decreased activity on the part of former purchasers, but simply to a substitution of liquid chlorine for the acid in a number of industrial processes. Before the war no liquid chlorine was manufactured in France. The little gaseous chlorine produced in the course of the electrolytic process for the manufacture of soda at that time was immediately converted into calcium chloride and marketed as such. When, however, imports of liquid chlorine from England and Italy during hostilities proved inadequate for carrying on intensive poison gas warfare, the French set up in 1915 seven plants in the Alps and the Pyrenees to utilize the hydro-electric power there. At the close of the war, when the armies no longer called for liquid chlorine, France found herself burdened with a production capacity of 70,000 tons per year and a consumption capacity of less than 18,000 tons per year.[35]

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[33] This decline was of 20 per cent. *Cf.* H. Bevierre, "La Verrerie," in *Chimie et Industrie*, p. 1279.

[34] Source: *Stat. Mens. Com. Ext.*

It was obvious that some of the liquid-chlorine plant equipment had to be dismantled, but only in so far as intensified domestic production and an enlarged foreign market could not absorb the product. If M. Barut's estimate of 25,000 tons production in 1923[36] is near the truth, both of these outlets must have undergone intensive development in the post-war period. The net imports during 1910–1913 indicate an average annual consumption of about 254 tons.[37] The net exports in 1923 of 70 tons make it appear that practically the whole 25,000 tons produced in that year were absorbed by French industry. A large part of the chlorine was destined for the manufacture of calcium chloride, as before the war. Another part was utilized in the preparation of stannic chloride which is used extensively in France for the weighting of black silks, but which before the war was imported from Germany. The rest competed with hydrochloric acid wherever the latter was used; or entered into chemical compounds, the demand for which increased with the rapid development of the French organic chemical and dyestuffs industries.

Another previously non-existent French industry which came into being as a result of the war was that of bromine. The salt marshes of Giraud and of Berre always contained this substance, but yielded it at a cost of production which was much too high to permit of competition with the German bromine of Stassfurt or the American bromine obtained from the brines of Michigan, Ohio and West Virginia. Under the stress of war requirements, even the uneconomical resources of France were exploited and bromine was sought in far off Tunis. Once hostilities were over, German and American bromines asserted themselves again on the French market because of their relative cheapness. France nevertheless maintained its bromine plant at the salt marshes of Giraud as part of its policy of military preparedness, and it is supposed too, that France may one day have an economical bromine industry of her own as a result of the discovery of bromine salts in the potash beds of Alsace. As the photographic, pharmaceutic, and dyestuffs industries develop in France, bromine is becoming more and more essential as a raw material.[38]

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[35] Ministère du Commerce, *Rapport général sur l'Industrie française*, Vol. II, pp. 70–71.

[36] Barut, *op. cit.*, *Chimie et Industrie*, Vol. I, p. 1267.

[37] See *Stat. Mens. Com. Ext.*

It is evident from the above indications of the growth of the sulphuric acid and nitric acid industries and of the birth of the French chlorine and bromine industries — the only two essential branches of inorganic chemical manufacture wanting in France before the war — that inorganic chemical production in France must have undergone a great expansion during the post-war years. It has been seen also that the production of soda increased from 372,000 tons in 1913 to 484,000 tons in 1924.[39] These inorganic, non-carbon chemical industries were considered apart only for purposes of exposition, for, in fact, their enlarged output was part and parcel of the development of the fertilizer and organic chemical industries whose rapid extension fell little short of constituting an industrial revolution in post-war France.

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[38] L. Hackspill et P. Remy-Genneté, "La Petite Industrie chimique minérale," in *Chimie et Industrie*, pp. 524–525; George Roché, "La Petite Industrie chimique," in *Chimie et Industrie*, pp. 1298–1299.

[39] See above, p. 435.

The Post-War Chemical Fertilizer Industry

Chemical or artificial fertilizers, which are distinguished from natural fertilizers such as manure, guano and bone-dust, fall into three main groups: nitrogenous, phosphatic and potassic. None of these contain carbon, and so their manufacture may be considered as part of the inorganic chemical industry. Nevertheless, they deserve to be considered apart because of their special destination. Indeed it is thanks to the recent advent of chemical fertilizers that the realization of Malthus's dismal prophecy has been put off *sine die*. Since the use of chemicals in agriculture is only at its very beginnings throughout the whole world, there seems to be no immediate prospect that population may outgrow the means of the soil to support it.

In France, particularly, there was room before the war for a wide extension in the use of nitrogenous fertilizers. Professor Matignon has estimated that in 1913 French agriculture consumed about 70,000 tons of nitrogen in one chemical form or another. On the average this amounted to 3 kilograms per hectare of arable surface, which compared quite unfavorably with 8 kilograms per hectare in Germany and 7.4 kilograms in Belgium. According to the same author, if the French yield per acre of wheat was to be raised to the level of these two countries, the French soil should be made to absorb at least 300,000 tons of nitrogen.[40]

It is not nitrogen that is lacking, for four-fifths by weight of the atmosphere is made up of this element. Difficulty, however, is experienced in combining nitrogen with other elements so that it may be assimilated by plants or utilized in industry. The process of converting nitrogen of the air into nitrogenous compounds is known as the fixation of nitrogen. Nature performs a certain amount of this, either by the decomposition of organic matter, manures, city sewage, etc., into ammonia and then into nitrates, or else by the direct absorption of atmospheric nitrogen in the nodules of the roots of certain leguminous plants such as red clover, beans, and cowpeas, where nitrate-making bacteria are found. It was because of the inadequacy of the quantity of assimilable nitrogen formed in this way that agriculture was obliged to have recourse to other sources of nitrates. These sources are three in number: Chilean nitrates, by-product ammonia, and synthetic nitrogen.

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[40] Camille Matignon, "L'Azote," in *Chimie et Industrie*, Vol. I, p. 414.

From the point of view of French industry as of French military policy, nitrates imported from Chile constituted the least desirable source of nitrogen whether for agriculture or any other purpose. The production of by-product ammonia in the form of ammonium sulphate, on the other hand, was not favored by post-war conditions, simply because it is derived mainly by way of the distillation of coal in the manufacture of coke or gas, and these latter industries were very limited in their development. It is estimated that the French production of ammonium sulphate obtained from coke-ovens, gas-works, metallurgical plants and city sewage altogether increased from 75,000 tons in 1913 to 100,000 tons in 1924.

The only source of nitrogen compounds capable of indefinite expansion as the demand for nitrates increases is the synthetic chemical industry. Two processes had been known and used in France before the post-war period began. They were the Birkeland-Eyde process and the cyanimide process. The former is too dependent on cheap and abundant electric current to have undergone any marked development in post-war France, and the latter, while it performed a very useful service to France during the war, was too expensive in comparison with other synthetic processes. The Haber-Bosch process, which consisted of the direct union of nitrogen and hydrogen to form ammonia under a pressure of 200 atmospheres, at a temperature of 500° Centigrade and in the presence of a proper catalyzer, had been developed very secretly in Germany before the war and was ready for industrial application there only in 1912.

France came into possession of this process after the war, and in a curious way. Although it was claimed that the French had a right to seize the Haber-Bosch patent without compensation by virtue of stipulations of article 297 of the Treaty of Versailles, it was found more prudent to enter into negotiations with the *Badische Anilin und Soda Fabrik Aktiengesellschaft.* When in 1919 French chemical manufacturers failed to come to an agreement among themselves for this purpose, the French State, motivated, no doubt, by the important rôle played by nitrogen in the manufacture of munitions, entered on November 11 of that year into a contract with the German firm by the terms of which France acquired the right to utilize the Haber-Bosch process upon payment of 5,000,000 francs in advance and of royalties on eventual production. The *Badische Anilin* agreed to lend its active coöperation in setting up the plant and in carrying on production.[41] Finally, after much discussion, a law was passed on April 11, 1924, authorizing the French State to organize the *Office National Industriel de l'Azote* (nitrogen), which was to build powder works in Toulouse for the exploitation of the Haber-Bosch and other processes.

In the meantime two other methods, both for the synthesis of ammonia, but under conditions of higher atmospheric pressure, were invented — one in France by Georges Claude, and the other in Italy by Casale. It appears that with the completion of the Toulouse state plant, in 1928, these processes, which were adopted by various French private chemical and coking firms, will be in some danger of being crushed in competition for purely economic reasons, since the capital charges of the state plant are much lower than those of the private factories.

Whatever fate the future may hold in store for the various processes, it is clear that the new synthetic methods of manufacturing ammonia vastly increased the amount of fixed nitrogen at the disposal of French agriculture and industry. The only synthetic nitrogen produced in France before the war, calcium cyanimide, amounted to 2,400 tons in terms of pure nitrogen in 1913. Not only was this output increased to 8,200 tons in 1924 but in that year about 5,000 tons of ammonia in terms of pure nitrogen were produced by the Claude process. Moreover, the French were rapidly pushing to completion the state powder works at Toulouse with an estimated capacity of 36,000 tons per year of nitrogen compounds in terms of pure nitrogen. The post-war French production of synthetic nitrogen as compared with pre-war production may be summarized as follows:

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[41] Michel Samsoen, *op. cit.*, pp. 96–104.

Source	French Production of Synthetic Nitrogen[42] (Tons of pure nitrogen)	
	1913	1924
By-Product Sulphate of Ammonia	15,000	20,000
Calcium Cyanimide............	2,400	8,200
Other Synthetic Nitrogen........	0	5,000
Total	17,400	33,200

The above figures underestimate the real activity of the French in their post-war endeavor to become independent of the rest of the world with regard to nitrates. They were building, in addition to the Toulouse powder works, several private plants for the utilization of the Claude and Casale processes with a capacity of 36,000 tons in terms of pure nitrogen. In all, therefore, the estimated synthetic nitrogen production anticipated for 1928 amounted to 105,000 tons of fixed nitrogen in terms of pure nitrogen.[43] When, however, this maximum estimate of the total French output in the immediate future is compared with the actual post-war production of only two large German plants (at Oppau and at Merseburg) amounting to 300,000 tons, then it is seen that the French synthetic nitrogen industry is still at its very beginning.

Further evidence of the need for considerable expansion of fixed nitrogen manufacture in France, whether in terms of sodium nitrate, ammonium sulphate, or calcium cyanimide and nitrate of lime, is seen in the foreign trade statistics which show for all these products an important excess of imports:

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[42] E. Rabaté, *op. cit.*, pp. 1251–1253.

[43] *Ibid.*

BALANCE OF TRADE IN PRINCIPAL NITROGENOUS PRODUCTS

(Excess of imports in tons) [44]

Year	Sodium Nitrate	Ammonium Sulphate	Calcium Cyanimide and Nitrate of Lime
1910–1913 (average)	328,702	22,506	3,050
1920	259,026	29,626	10,549
1921	307,077	64,048	7,182
1922	158,114	63,675	2,508
1923	271,608	61,990	23,428
1924	271,579	114,907	20,426
1925	325,100	124,939	26,972
1926	170,488	192,274	53,907
1927	332,792	175,675	31,889

If the 1924 imports be reduced by a rough approximation to terms of pure nitrogen on the basis of a 15 per cent yield for nitrate of soda, a 20 per cent yield for ammonium sulphate, and a 15 per cent yield for calcium cyanimide and nitrate of lime, then it is observed that about 67,000 tons of fixed nitrogen in terms of pure nitrogen were imported, as compared with the 33,000 tons of fixed nitrogen produced in France in that year. If, furthermore, it be recalled that the French soil alone (no estimate of industrial needs being available) is capable of absorbing 300,000 tons of pure nitrogen, then one must conclude that the 1924 production capacity of the synthetic nitrogen industry in France could satisfy only about a tenth of the probable domestic requirements.

Next in importance to the nitrogenous fertilizers are the phosphates. The chemical industries connected with the manufacture of phosphatic fertilizers were highly developed in France before the war. This was due principally to the fact that France controlled very large mineral phosphate resources in Tunis — second only to those of the United States. A certain amount of natural phosphate rock was mined also in Algeria and in France itself. The total of 2,847,000 tons extracted under the French flag represented about 40 per cent of the estimated world production.[45] Since by far the greater part of natural phosphate was and still is converted into superphosphate by treating the rock phosphate with sulphuric acid to make it soluble, it is not astonishing that France should have been at that time the most important European producer of superphosphates, with Germany running a close second because of the latter's vast sulphuric acid output:

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[44] *Stat. Mens. Com. Ext.*

Country	*Superphosphate production in 1913 (In thousands of tons)*
United States	3,248
France	1,920
Germany	1,819
Italy	972
England	820
Belgium	450

Such was the pre-war production of only one form of phosphatic fertilizer, for in addition to superphosphates about 730,000 tons of basic slag poured forth from the French blast furnaces in the year that preceded the war.

The post-war years witnessed a remarkable expansion of the phosphatic fertilizer industry. Though the beds in France itself yielded about 25 per cent less of phosphate rock in 1925 than in 1913, this was of little significance to the chemical industry, for generally the French phosphates were utilized directly by French agriculture and metallurgy without any chemical elaboration. Of much more importance was the fact that the output of the Tunisian beds increased from 2,170,000 tons in 1913 to 2,537,000 in 1925, and that of the Algerian beds from 338,000 tons to 717,000, while the Moroccan resources which had been first discovered in 1917 yielded 672,000 tons in 1925. How much mineral phosphate came to France to be fed for the most part into the superphosphate industry can be seen in the following table:

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[45] *Annuaire Statistique, 1926*, p. 300.

Year	*Net imports of natural phosphates*[46] *(In tons)*
1913	919,649
1921	699,629
1922	1,148,347
1923	1,321,147
1924	1,341,879
1925	1,290,657
1926	1,500,913
1927	1,491,932

In view of the increased mineral phosphate at the disposal of French industry, and in view also of the enlarged French production of sulphuric acid,[47] which has already been discussed, it was but natural that the superphosphate industry should have grown to unprecedented proportions in the post-war period:

Year	*French production of superphosphates*[48] *(In thousands of tons)*
1913	1,920
1921	1,404
1922	2,133
1923	2,215
1924	2,304
1925	2,381

In fact this production was even larger than was necessary to satisfy the increasing domestic needs, as is clear from the following table of the excess of exports of superphosphates (see page 458).

It has already been observed how the basic slag output expanded with the acquisition of the new blast furnace equipment in Alsace-Lorraine.[49] This production is, therefore, a by-product of

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[46] See *Stat. Mens. Com. Ext.*

[47] The manufacture of 1.8 tons of superphosphates requires one ton of rock phosphate and one ton of sulphuric acid.

[48] *Annuaire Statistique, 1926*, p. 304.

[49] See above, p. 444.

Year	*Net exports of superphosphates* [50] *(In tons)*
1913	144,404
1921	23,657
1922	37,346
1923	63,303
1924	202,673
1925	207,238
1926	269,787
1927	265,279

the metallurgical industry, for slag needs only to be ground into very fine powder to be used as a fertilizer. If the production of slag less net exports [51] be reduced to terms of pure phosphorus on the basis of a 7.5 per cent yield, and if in the same way the apparent consumption of superphosphates be reduced to terms of pure phosphorus on a basis of a 7 per cent yield, then the movement in the amount of phosphorous absorbed by French soil may be roughly measured. No account is taken of the ground phosphates, ground bone, bone superphosphates, etc., which are used in smaller quantities and which are also sources of phosphorus for agriculture.

Year	*Consumption of phosphorus in France in principal phosphate fertilizers (In thousands of tons)*
1913	163
1921	106
1922	172
1923	179
1924	183
1925	182

It is obvious from the above figures that although the production of phosphatic fertilizers increased by leaps and bounds from year to year in the post-war period, the consumption remained almost stationary from 1922 to 1925. The export market was being developed all the time, to be sure, but the French soil probably required more of this sort of fertilizer than it received.[52]

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[50] Designated in the French foreign trade statistics as *superphosphates minéraux.* See *Stat. Mens. Com. Ext.*

[51] See *Stat. Mens. Com. Ext.*

Neither the increase in the superphosphate industry nor the extraordinary growth of the synthetic nitrogen industry show anything as striking as the contrast between French pre-war and French post-war potash production. France was indeed transformed from a country with no potash industry at all, dependent on imports for practically all the potash required whether for agriculture or industry, into the second largest potash producer in the world.[53]

While potash salts are sometimes obtained from wood-ashes, from the ashes of certain seaweeds, from sugar-beet and molasses residues, from wool scourings, and from brines of certain salt lakes, these sources are all insignificant when compared with the potash mines of Stassfurt in Germany and of Mulhouse in Alsace. It was, therefore, by virtue of the reannexation of Alsace that France became an important potash country. It should be added, however, that her position as a potash producer was not due merely to the passive acceptance of the terms of the Treaty of Versailles but to a very active amelioration of the mines and the potash works connected with them.

Were it not for the chemical plants annexed to the potash mines in Alsace, potash production would only be of interest as a mineral industry rather than as a chemical industry. Much of the sylvinite salts extracted from the mines is sold in its crude form, either as ordinary sylvinite with a potash content of 12 to 16 per cent, or as rich sylvinite with a potash content of 18 to 22 per cent, depending upon whether the salts are extracted from the lower or upper layers of the potash beds. Both agriculture and industry demand, however, a higher degree of concentration of potash, which is arrived at by converting the crude sylvinite salts into more or less pure chloride of potash. Since the crude sylvinite consists of a mixture of sodium chloride (ordinary salt) and potassium chloride, chemical plants effect the separation by dissolving the mineral salts in water and then raising the temperature which causes the sodium to precipitate out, since the solubility of sodium chloride

[52] E. Rabaté, *op. cit.*, p. 1257.

[53] See p. 577.

in the presence of potassium chloride diminishes as the temperature rises.

The story of French production and trade in potash under conditions, first of internal combination of which the State was a participant, and then of international combination to which the French State remained a party in collaboration with the German Kalisyndikat, is one which can be more properly told in the chapter on "The Combination Movement."[54] It suffices here to point out that the output of potassic products in terms of pure potash (potassium oxide) increased during the post-war years in the following proportions:

Year	*Production of potassic salts in France in terms of pure potash (In tons)* [55]
1921	148,940
1922	207,000
1923	248,700
1924	270,990
1925	310,000
1926	366,000
1927	372,000

At the same time the net exports of chloride of potash fertilizers, whether in the form of the crude mineral or of the concentrated salts, also expanded:

Net Exports of Chloride of Potash Salts [56]
(In tons)

Year	*Crude salts*	*Chloride of potash*
1921	132,184	123,164
1922	561,729	34,746
1923	631,366	27,984
1924	653,189	40,865
1925	666,568	42,897
1926	629,863	46,155
1927	620,350	39,768

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[54] See Chapter XVIII, pp. 576–579.

[55] *Bulletin de la Statistique Générale de la France.*

[56] See *Stat. Mens. Com. Ext.*

As for sulphate of potash, which is also used as a fertilizer, it is obvious from the following figures that the production of the Alsatian potash beds was beginning at the very close of the period under survey not only to reduce France's dependence on foreign sources but to yield a substantial excess for exportation:

Year	*Net imports of sulphate of potash*[57] *(In tons)*
1910–1913 (average)	14,371
1920	1,215
1921	1,305
1922	478
1923	−252 (excess of exports)
1924	3,622
1925	2,539
1926	1,223
1927	−2,040 (excess of exports)

That there is a possibility of a vast future development of the French potash industry, if only for domestic consumption of the product, cannot be doubted, for over 90 per cent of the salts extracted are destined for agriculture, and the French soil in 1925 was made to absorb per acre of cultivated surface less than one-seventh of the pure potash fed to the soil in Holland.

Country	*Consumption of potash fertilizer in terms of pure potash per square kilometer of cultivated area, in 1925*[58] *(In kilograms)*
Holland	2,600
Germany	2,300
Scandinavia	500
France	350
Great Britain	250
United States	100

It appears, therefore, that the post-war situation as regards French chemical fertilizers is a very favorable one. In Alsace, France possesses sufficient potash resources to satisfy the needs of the whole world. In North Africa, France has beds of phosphate rock capable of supplying all Europe. After the reannexation of Alsace-Lorraine, France became as great a producer of basic slag as Germany. Moreover, the synthetic nitrogen industry was being rapidly developed with an eye to rendering France independent of imports. Thus in the post-war years the French chemical industry has made a vigorous effort to provide adequate quantities of nitrogen, phosphorus and potassium, the three elements essential to revivifying and enhancing the productive powers of the soil.

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[57] *Ibid.*

[58] League of Nations, *Potash Industry*, p. 12.

The Post-War Organic Chemical Industry

The historical circumstances which led to the inferiority, not to say the total inadequacy, of the pre-war French organic chemical industry have already been discussed. It is difficult to measure the progress realized by France during and after the war, because of the bewildering number and variety of chemical products of which carbon is a constituent part. Nor is the distinction between organic and inorganic industries more than a purely theoretical one, for inorganic chemicals are practically always utilized in the elaboration of organic products, and very frequently inorganic substances are manufactured as important by-products in manufacturing processes essentially organic. Thus, for example, sulphate of ammonia and hydrogen (required in large quantities for manufacturing synthetic ammonia) are by-products of the distillation of coal, which yields as principal products coke and coal tar. Furthermore, the increased French post-war output of the principal inorganic acids, soda, chlorine, etc., was used very largely by the expanding organic chemical industries. There is, however, one branch of organic chemical manufacture that stands out as of primary importance, utilizing the same basic raw materials and intermediate substances as other organic industries, and generally bound up in such a way with all organic processes as to make its development indicative of the expansion of the whole organic industry. That is the manufacture of synthetic dyestuffs.

There were, before the war, ten synthetic dyestuff factories in France, only four of which were French, five being German and the remaining one Swiss. All of these foreign plants were mere finishing branches of factories in Germany and Switzerland. And three out of the four French factories did little more than elaborate intermediate products received for the most part from Germany. Only one French firm, at Saint Denis near Paris, was engaged in the manufacture of synthetic dyestuffs from the raw materials to the finished product. Of the 9000 tons of dyestuffs which, it is estimated, France consumed in 1913, about 2000 tons were imported in their finished state, and all but an insignificant proportion of the rest were imported in a partially manufactured state simply to undergo the final process of manufacture in France.[59] How small the French synthetic dyestuffs industry was on the eve of the war may be seen from the following estimates:

Country	*Production of aniline dyes in 1913*[60] (*In thousands of tons*)
Germany:	
(a) within Germany	127
(b) in branches outside Germany	10
Switzerland	10
Great Britain	5
United States	3
France	2

In the post-war period the dyestuffs situation was completely changed. The war, in cutting off commercial relations with Germany, started France on her career as synthetic dye manufacturer. Although the German plants in France were sequestrated at the very opening of hostilities, they were at first useless in the absence of deliveries of necessary crude and intermediate products. In spite of the fact that practically the whole organic industry was directed toward the manufacture of explosives in the war days, the government *Office des Produits Chimiques* authorized and stimulated the construction of highly integrated plants for the manufacture of dyestuffs from the raw material to the terminal product. The old firms, like that of Saint Denis and the sequestrated German firm near Creil, increased their output, and in addition new companies were formed: the *Compagnie Française de Produits Chimiques et Matières Colorantes de Saint Clair du Rhône*, the *Société de Produits Chimiques et Colorants Français*, and finally the *Compagnie Nationale de Matières Colorantes et de Produits Chimiques.* The last named was the dominant dye producer of France from 1916 to 1923 when it was absorbed by the *Établissements Kuhlmann* (a French and not a German firm, founded near Lille by Frederic Kuhlmann, an Alsatian by birth, in 1825).

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[59] J. de Kap-Herr, "Les Matières colorantes," in *Chimie et Industrie*, Vol. I, p. 1311–1312.

[60] C. Ungewitter, *op. cit.*, p. 28.

As a result of this war-time effort, out of a total consumption of about 10,000 tons of dyestuffs in 1920 5,900 tons (59 per cent) were imported; and in 1921, a depression year, out of a 7,000 ton consumption only 1,200 tons (17 per cent) were imported.[61] The *Compagnie Nationale*, which had acquired the exclusive use in France of numerous patented and other secret processes, was manufacturing and marketing about 100 different dyes in 1920, and by the middle of 1922 increased its variety of products to over 600.

From the end of the war up to January 10, 1923, French products had to compete with German dyestuffs which were coming into France in part payment of reparations. On that date Germany stopped all such deliveries as a measure of reprisals against France on account of the occupation of the Ruhr. Nothing could have been more fortunate from the point of view of the development of an autonomous French dyestuffs industry. It was then that the French manufacturers set up new plant equipment for the manufacture of the necessary crude and intermediate chemicals. When the Ruhr conflict ended, and new arrangements were made in London in 1924 for future reparation deliveries in kind, it was found that France could produce on her own soil about 95 per cent of her needs and that only 4 or 5 per cent had to be imported.[62] What an amazing contrast with the pre-war situation, when only

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[61] J. R. Cahill, *Report on the Economic Conditions of France, 1923*, pp. 98–99, and Kap-Herr, *op. cit.*, p. 1314.

[62] Kap-Herr, *op. cit.*, p. 1316.

5 per cent of the pre-war home consumption was the product of French owned factories!

The foreign trade statistics reveal, perhaps better than anything else, the degree of autonomy attained by the French synthetic dyestuffs industry. In the following table are given the net exports (+) or the net imports (−) of the main categories of coal-tar dyes:

BALANCE OF TRADE IN COAL-TAR DYES[63]
(In tons)

Year	Azo Dye-stuffs	Azilarine Dyes	Di- & Tri-phenyl-methane	Sulphur Dyes	Indigo-tine Vat Dyes	Azine Dyes	Others	Total
1920	−2,002	−485	−309	−366	+2,180	−1,108	−463	−2,553
1921	−599	+15	+166	−270	+2,179	−63	−121	+1,325
1922	−903	−84	+145	−720	+139	−288	−197	−2,186
1923	−280	+251	+722	−540	+202	−181	+63	+237
1924	−558	+14	+184	−360	+2,187	−650	+387	+1,204
1925	−85	−126	+862	+31	+2,363	−251	+694	+3,488
1926	+97	−80	+788	+205	+2,107	−481	+598	+3,234
1927	+635	−37	+651	+409	+2,358	−655	+202	+3,563

It will be observed that in practically every case, there was either a sharp diminution of imports from 1922 to 1923, the Ruhr year, or a change from an excess of imports to an excess of exports. In 1927 France appeared to be not only self-sufficient in all but the alizarine and azine dyes, but in fact an exporter of most synthetic coal-tar dyestuffs.

Progress in the manufacture and trade of synthetic dyestuffs, such as has just been described, implies an important development of those industries that distill coal and recover the coal-tar by-products. It has been estimated by M. Duchemin that the French output of coal tar increased from 280,000 tons in the pre-war days to 425,000 tons in 1924.[64] About 100,000 tons, according to M. Duchemin, were utilized directly for roads and other purposes.

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[63] See *Stat. Mens. Com. Ext.*

[64] R.-P. Duchemin, "L'Industrie chimique française," in Union des Industries Chimiques, *Bulletin Mensuel*, March 1925, pp. 81–82.

The remaining 325,000 tons were distilled, yielding 19,000 tons of crude naphthaline, 1,500 tons of 40 per cent anthracene, 5,000 tons of phenols and 5,000 tons of benzols to which should be added about 55,000 tons of benzols derived from coke-oven and other gases. This production, according to M. Duchemin, was adequate for the dyestuffs industry, but insufficient to meet the demands of a multiplicity of other industries all using the same crude substances. That explains why there continued to be an excess of imports of crude coal-tar products in the entire post-war period. The rapid and steady decline in this unfavorable balance from 1922 on points to a probable complete independence of imports in the future.

Year	*Excess of imports of crude coal-tar products* [65] *(In tons)*
1910–1913 (average)	88,700
1919	27,197
1920	69,539
1921	73,971
1922	86,523
1923	58,841
1924	41,500
1925	12,689
1926	4,320
1927	39,139

The movement toward self-sufficiency was somewhat less marked in the manufacture of coal-tar intermediates, according to foreign trade statistics. The intermediates are, in fact, nothing but partially elaborated coal-tar chemicals derived from the crudes and ready to be converted by the finishing processes into dyestuffs, medicines, photographic chemicals and a host of other terminal products.

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[65] See *Stat. Mens. Com. Ext.*

BALANCE OF TRADE IN PRINCIPAL COAL-TAR INTERMEDIATES[66]

(In tons)[67]

Year	Carbolic Acid	Analine, its Salts and Derivatives	Paratoluidine	Paranitranaline	Naphthylamines (*beta*)
1920	+76.8	−389.3	−45.5	−159.3	−56.7
1921	+54.7	−3.0	−73.2	−38.9	−21.4
1922	+11.2	+69.1	−56.4	−59.9	−12.6
1923	+155.3	+953.5	−44.5	−38.0	+18.7
1924	+15.2	+205.9	−50.2	−37.4	+48.3
1925	−8.1	+554.0	−20.0	−78.7	+96.6
1926	−127.0	+502.9	−64.1	−24.8	+35.0
1927	−48.2	+1,046.1	+70.3	−33.4	+33.3

It may very well be that the excess of imports of carbolic acid from 1925 to 1927 and the fairly constant dependence on foreign sources for paratoluidine and paranitraniline were due to the greater demand for these products by the terminal industries than to any stagnation or lack of expansion in their production. An outstanding feature in these foreign trade statistics is the increasingly large exports of analine, its salts and derivatives and of the *beta* naphthylamines, which are exceedingly important intermediates.

Conclusion

A general survey of the French chemical industry, organic as well as inorganic, reveals a tremendous development of productive capacity and of foreign trade, these phenomena being largely a result of the war. In aniline dyestuffs, for example, according to the German estimates, French productive capacity increased from 2,000 tons in 1913 to 19,000 tons in 1924, while the actual output attained the figure of 15,000 tons in that year.[68] According to the British estimate, the capacity increased from 7,000 tons in 1913 to 25,000 tons in 1924, with actual production at 17,000 tons.[69] The difference between these two estimates is considerable, but the conclusions which may be drawn from them, as well as from the foreign-trade statistics considered above, are the same. The excess of capacity over production indicates that the home industry was capable of meeting domestic needs — except for certain specialities perhaps — and had a surplus for exports which was capable of considerable increase. That was true not only of dyestuffs, but of sulphuric, nitric, hydrochloric acids, liquid chlorine, basic slag, potash, and superphosphates, and it may be true before long of nitrates too.

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[66] See *Stat. Mens. Com. Ext.*

[67] + = excess of exports; − = excess of imports.

[68] C. Ungewitter, *op. cit.*, pp. 28–29.

As a natural consequence of this situation, French manufacturers endeavored to obtain customs protection with a view to maintaining their supremacy in the home market, and also, with or without state assistance, to increasing their exports to foreign markets.[70] An effort of this sort required concerted action on the part of all large chemical firms in defense of common interests and for the pursuance of common aims. Thus on April 7, 1927, the *Comité Central des Produits Chimiques* was formed, uniting the dominant companies such as the *Établissements Kuhlmann*, *Établissements Alais*, *Froges et Camarques* and *Établissements Saint-Gobain*, with a program not unlike that of the *Comité des Forges* for the metallurgical industry, or that of the *Comité des Houillères* for the coal industry. Within the country, post-war French chemical production was concentrated in the hands of a few powerful firms which were more or less closely combined through organizations and financial participations.

In seeking elbow-room in the field of international commerce French exporters often clashed with exporters of other industrial nations. To avoid serious conflict there was but one solution, an international entente for rationing output, for specializing production, and for the division and apportionment of markets. How this was accomplished in connection with the potash industry is described in another place.[71] The French superphosphate producers seem to be on a fair way to entering more or less formally into a similar agreement with the superphosphate producers of the rest of the world. That appears to be the object of the international superphosphate trade association the center of which is in London. There can be little doubt but that post-war production and trade in other branches of the French chemical industry were perhaps less rigidly, but hardly less effectively, regulated not only through express agreements and organizations but through international financial participations. That is why it would perhaps be rash to attempt to prophecy anything with regard to the future of the French chemical industry which will depend more on international considerations than on purely national ones.

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[69] The Association of British Chemical Manufacturers, *op. cit.*, pp. 84–85.

[70] R.-P. Duchemin, "The Main Aspects of the Chemical Industry throughout the World as seen from a French Standpoint," in the League of Nations, *The Chemical Industry*, p. 108.

[71] See Chap. XVIII, "The Combination Movement."

CHAPTER XVI

AGRICULTURE

1. Agriculture in Pre-War France

Before the war, agriculture occupied a place of primary importance in the economic life of France. According to the 1911 census, while 38 per cent of the gainfully occupied male population was engaged in industry, and 9 per cent in commercial pursuits, 40 per cent was engaged in agriculture. More than half (exactly 55.8 per cent, 1911 census) of the total French population lived in rural districts, that is to say, in agglomerations of less than 2,000 inhabitants.[1] From the point of view of international comparisons too, pre-war France may be classed among the nations predominantly agricultural.

Country	Census	Proportion of Gainfully Occupied Males Engaged in Agriculture [2]
Bulgaria	1907	74%
Hungary	1910	64
Russia	1897	61
Portugal	1910	57
Italy	1911	54
Austria	1910	48
Sweden	1910	43
France	1911	40
United States	1910	36
Switzerland	1920	32
Germany	1907	28
Holland	1920	26
Belgium	1910	19
Great Britain	1920	10

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[1] See above, Chart XXI, p. 205.

[2] Source: *Annuaire Statistique, 1924*, pp. 192–193. The divergencies in the census-taking practice of different countries make comparative statistics of the feminine

In 1913 there were in France 91,319 square miles of arable land representing nearly half (44.7 per cent) of the total area of the country. This was certainly land enough to produce an enormous quantity of foodstuffs, but it must be remembered that with an average population density of 194 persons per square mile the demands upon the arable surface were relatively intense. The United States had at that time about five times as much arable land with a population only two and a half times as great. Nevertheless, this pressure of population on the land was less in France than in most other European countries.

Thanks to the intensive culture practiced in France, her 91 thousand square miles yielded before the war almost enough to feed the whole French population. During the years from 1909 to 1913, 88 per cent of the wheat consumed in the country was home grown. Practically all the meat was of domestic origin, since imports represented but one per cent of meat production in France.[3]

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as well as the masculine gainfully occupied extremely untrustworthy. In some countries only women who receive money wages are enumerated as employed in agriculture, while in other countries farmers' wives and other women receiving no regular pay as such are also included. Moreover the amount and kind of farm work done by women undoubtedly varies considerably from country to country. The following table gives the combined figures:

Country	Proportion of Gainfully Occupied Population (Male and Female) Engaged in Agriculture
Bulgaria	82%
Hungary	62
Russia	57
Austria	56
Italy	55
Portugal	53
France	41
Sweden	39
Germany	35
United States	33
Switzerland	28
Holland	23
Belgium	16
Great Britain	7

[3] "The Meat Supply of France," article in *Foreign Crops and Markets*, U. S. Department of Agriculture, April 13, 1925, p. 412.

In fact, there is evidence to show that domestic production of foodstuffs, generally speaking, covered more than 90 per cent of the needs of the country.[4]

One of the most striking characteristics of French agriculture was, and still is, the prevalence of small farms and the predominance of peasant holdings. This feature of French rural life is one of long standing. It dates back to the French Revolution, and a strong tendency in the direction of the parcelling of farm land ownerships was observable even before then. In 1892 the number of farms of less than 10 hectares (25 acres) constituted 85 per cent of the total number of farms in France, and those of 1 hectare (2.5 acres) constituted 39 per cent. This contrasts rather sharply with conditions in the United States, where only 12.5 per cent of the farms were under 20 acres (8 hectares). It must not, however, be supposed that large farm estates did not exist in France, for while farms of over 40 hectares (100 acres) represented only 2.5 per cent of the total number of French farms, these few large agricultural estates covered 43 per cent of the total farm area of the country. It is clear, too, that most of the small farms were actually owned by the peasant-farmers. Only about 30 per cent of the number of farms in France were cultivated by tenants, 22 per cent of them being cash tenants and the rest being *metayers* who pay rent in the form of a fixed proportion of the annual produce. The tenant farmers tilled about 47 per cent of the total acreage under cultivation.

Although the prevalence of small farms was conducive to intensive cultivation, the average annual wheat yield per acre in France in the decade 1904–1913, while far in advance of that of the United States, was inferior to the yield of most of the neighboring European countries. A rather similar situation is to be seen with regard to the production of potatoes. Here again France was behind Belgium, Holland and Germany, but ahead of the United States and Italy:

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[4] This estimate was made by comparing the foreign figures of net imports (imports minus exports) of foodstuffs with the estimate of the value of foodstuffs produced in France in 1912. See *Rapport du Comité des Experts*, p. 131. For this calculation items properly designating foodstuffs were taken from the experts' estimate of the value of French agricultural production.

Country	*Annual wheat yield per acre in bushels*[5] *(average 1904–1913)*	*Annual potato yield per acre in bushels (average 1904–1913)*
Denmark	44.9	209.8
Belgium	36.4	253.2
Holland	35.5	208.2
Great Britain and Ireland	32.4	213.8
Switzerland	31.8	.....
Sweden	30.6	159.7
Germany	30.6	204.3
Norway	24.5	227.8
France	20.1	130.1
Austria	19.9	156.3
Canada	19.0	161.3
Hungary	18.4	117.9
Roumania	17.1	51.0
Bulgaria	15.5	57.1
United States	14.7	96.4
Italy	14.4	85.4
Serbia	13.5	48.9
Spain	12.9	.....
Russia	9.8	110.3

However low the relative position of France may be in the above tables, this fact does not justify any hasty conclusion branding French agriculturists with general inferiority. The factors influencing yield are too manifold and often impersonal — comprising the quality of the land, moisture, temperature, labor supply and density of population as well as agricultural knowledge, the use of fertilizers and the routine technique of the peasant.

In the decade that preceded the war (1904–1913) the distribution of the principal crops was somewhat as follows: About 20 per cent of the productive acreage[6] of France was given up to the cultivation of wheat, and 22 per cent to other cereals, so that little less than half of the cultivated surface of France was devoted to the production of cereal crops. Wheat culture was scattered fairly widely over the whole territory of France except in the mountainous regions of the southeast and south central districts. Cereal farming was particularly characteristic of the northwest and southwest. The permanent meadow, grass and pasture lands, which made up 30 per cent of the total area under consideration, were situated principally in the southeast and south central portions of France. Forage crops and artificially sown grasses covered 15 per cent, while potatoes and grapevines each covered 5 per cent. Viticulture is the agricultural specialty of the river valleys, especially in the south. The northern limit of grapevine growing cuts off the northwest of France. Although the raising of crops for industrial purposes (sugar beets, flax, linseed, tobacco, etc.) was an important feature in French agriculture, only a little more than one per cent of the crop-yielding land was used for such purposes. Leguminous plants and truck crops demanded less than two per cent of the productive surface of France.

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[5] Source: *Annuaire Statistique.* Computed by multiplying by 1.487 the data given originally in quintals per hectare. A bushel of potatoes or of wheat was taken as equal to 60 lbs., a hectare as 2.471 acres and a quintal as 220.46 lbs.

[6] The total productive acreage of France for the purpose of these comparisons includes lands devoted to categories of crops described in the official statistics as fol-

Before the war, out of a total area of 131 million acres, only 9 millions were waste lands — not including city lands and roads. There were, besides the productive areas above treated, 24.5 million acres of wooded tracts, chiefly in the mountainous regions.

2. Post-War Agricultural Production

It has already been observed that French agriculture did not make as rapid a recovery after the war as French industry.[7] Indeed, one of the most striking features of post-war France was the failure of foodstuffs production to come up to the pre-war level. The falling off in crop yields was especially notable in the case of

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lows: "1. céréales, 2. légumineuses, 3. tubercules, 4. cultures fourragères, 5. cultures industrielles, 6. horticulture fruitière et florale, 7. pépinières, 8. cultures maraîchères, 9. vignes en production." The average number of hectares so employed from 1904 to 1913 was 32,527,000. See *Statistique Agricole Annuelle* (Paris, Imprimerie Nationale), tableau 29.

[7] See above, pp. 105–107.

wheat, to the cultivation of which one-quarter of the arable land[8] of France is devoted. In the years 1924–1926 the annual average production of wheat was about 12 per cent below that of France and Alsace-Lorraine combined during 1909–1913. Despite the fact that the regions devastated by the war were more industrial than agricultural, the French wheat yield in 1919 was only 58 per cent of the pre-war crop:

Year	*Wheat crop of France*[9] *(In millions of quintals)*
1909–1913 average (pre-war territory)	86.4
1909–1913 average (including Alsace-Lorraine)	88.6
1919 " " "	50.9
1920 " " "	64.5
1921 " " "	88.0
1922 " " "	66.2
1923 " " "	75.0
1924 " " "	76.5
1925 " " "	89.9
1926 " " "	63.1

The above year-to-year fluctuations in output and the prevailing shortage in the post-war wheat crop as compared with pre-war production were consequences of the uncontrollable factor of changing weather conditions and of the diminishing surface sown in wheat, rather than of any decrease in yield per acre. Immediately after the war the wheat area was about a third less than what it had been during 1909–1913. Even from 1923–1926 it was still a fifth less than the wheat area before the outbreak of hostilities. The yield per acre, however, was greater in 1921, 1923, 1924 and 1925 than the average yield for 1909–1913; and for the eight-year post-war period it averaged two per cent more than during the five years immediately preceding the war:

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[8] Arable land (terre labourable) should be distinguished from the productive surface (p. 473, note 6) for the former does not include meadows, pastures, vineyards or truck farms.

[9] The data of this and the following tables were taken from the *Statistique Agricole Annuelle*, except the 1926 figures which were found in the *Journal Officiel*, July 16, 1927. The statistics for Alsace-Lorraine, 1909–1913, were communicated by the Office de Statistique d'Alsace et de Lorraine.

YEAR	WHEAT AREA (In millions of hectares)	YIELD OF WHEAT (In quintals per hectare)
1909–1913 (pre-war territory)	6.54	13.2
1909–1913 (including Alsace-Lorraine)	6.68	13.3
1919	4.71	10.8
1920	5.09	12.7
1921	5.38	16.4
1922	5.29	12.5
1923	5.53	13.6
1924	5.51	13.9
1925	5.61	16.0
1926	5.25	12.0

What was true of wheat in the post-war period was equally true of all cereals including oats, rye, barley, buckwheat, and maize:[10]

YEAR	CEREAL ACREAGE (In millions of hectares)	ANNUAL CEREAL CROP (In millions of quintals)	YIELD OF CEREALS (In quintals per hectare)
1909–1913 (pre-war territory)	13.6	173	12.8
1909–1913 (including Alsace-Lorraine)	13.9	179	12.9
1919	9.8	97	9.8
1920	10.8	133	12.3
1921	11.2	150	13.4
1922	11.1	135	12.2
1923	11.3	151	14.0
1924	11.4	152	13.3
1925	11.5	169	14.8
1926	11.4	141	12.4

[10] The relative importance of grains other than wheat in French cereal production is seen in the fact that the oats crop averages about half that of wheat, while rye and barley each average about a seventh or eighth of the wheat crop. Buckwheat and maize are produced only in small quantities.

Notwithstanding a very perceptible average increase in the yield per acre, the post-war cereal crops remained constantly below the pre-war crops, owing principally to the great shrinkage in territory given up to grain production. The surface under cultivation for cereals was about 18 per cent below the pre-war cereal acreage, and production during the same period was about 15 per cent below the pre-war standard.

Potatoes are another very important food-crop of which the post-war production decreased considerably. The post-war potato acreage, which amounted to about a quarter of the surface devoted to wheat, was over 10 per cent smaller than the pre-war potato acreage:

YEAR	POTATO ACREAGE (In millions of hectares)	POTATO CROP (In millions of quintals)	YIELD OF POTATOES (Quintals per hectare)
1909–1913 (pre-war territory)	1.55	133	85.8
1909–1913 (including Alsace-Lorraine)	1.65	143	87.0
1919	1.34	85	60.0
1920	1.44	116	87.2
1921	1.46	83	57.1
1922	1.46	126	86.4
1923	1.45	99	68.3
1924	1.46	154	104.9
1925	1.47	152	103.7
1926	1.46	111	76.3

Although, as the above table indicates, the area cultivated for potatoes remained fairly constant from 1920 on, the successive annual crops varied a good deal during the post-war period. The average annual yield was about 15 per cent less than what it had been in the course of the five years that preceded the war.

The production of forage crops constituted another essential item in French agriculture, for fodder is the basis of meat production. The total value of forage crops is estimated at a figure not much lower than that of cereals. Unlike cereals, and unlike potatoes, however, fodder was cultivated in post-war France over a more extensive area than had been the case before the war. In 1926 it was 5 per cent greater. This increase in acreage of forage crops, as contrasted with the diminution in cereal and potato acreage, is perhaps to be attributed more to the shortage of labor than to the stimulus of rising meat prices. Few farm hands are required to raise fodder, and some types of forage crops, such as meadow grasses, require hardly any attention.

The influence of the low agricultural labor supply is seen also in the changing relative position of the different forage crops after the war. Thus, the surface producing clover, alfalfa, sainfoin, turnips, cabbage and mangolds — all high grade forage crops demanding a fair amount of labor — was 5 per cent smaller in 1925 and 4 per cent smaller in 1926 than in 1909–1913. Again, the acreage devoted to annual green forage crops was almost 10 per cent below that before the war. Moreover, the yield per acre in all these cases was (except for two years) smaller than in the pre-war years, indicating a lack of labor. On the other hand, temporary meadow land increased in area by nearly 50 per cent over the pre-war acreage. These lands were sown in certain kinds of peas, beans and grasses used for feeding animals. Their yield per acre was, however, considerably smaller than before the war:

Year	Clover, Alfalfa, Turnips, Mangolds, etc.		Green Forage Crop		Temporary Meadows	
	Acreage (In millions of hectares)	Annual crop (In millions of quintals)	Acreage (In millions of hectares)	Annual crop (In millions of quintals)	Acreage (In millions of hectares)	Annual crop (In millions of quintals)
1909–1913 (including Alsace-Lorraine)	4.3	469	.77	147	.28	10
1919	3.6	258	.67	84	.35	9
1920	3.8	376	.69	96	.36	10
1921	3.8	278	.70	69	.37	9
1922	3.9	400	.69	93	.37	11
1923	4.0	372	.71	92	.38	12
1924	4.0	471	.78	118	.39	12
1925	4.1	471	.69	121	.41	13
1926	4.1	381	.70	108	.44	13

A large part of the productive surface of France consists of permanent meadow and pasture lands. The fact that some of this land on hillsides is not very productive is more than compensated by the hay crops which are often harvested more than once a year. After the war the area used for permanent meadows and pasture was greater than before, and it increased steadily from year to year. In 1919 it was 5 per cent greater and in 1926 9 per cent greater. Much land previously cultivated for other crops was left in the post-war period for meadow and pasture. While the annual crops from this source were superior to what they had been before the war, the increase was not in proportion with the expansion in acreage:

PERMANENT MEADOW AND PASTURE LANDS

Year	Acreage (In millions of hectares)	Annual Crop (In millions of quintals)
1909–1913 (including Alsace-Lorraine)	10.3	269
1919	10.8	229
1920	10.9	262
1921	10.9	224
1922	10.9	251
1923	10.9	278
1924	11.0	288
1925	11.2	312
1926	11.2	283

The wider acreage devoted to forage crops would lead one to expect an increase in the number of cattle and other farm animals. Such, however, was not the case, for the annual statistics reveal a decrease. It was reported in 1926 that there were 4 per cent fewer cattle in France and Alsace-Lorraine than before the war, but these statistics may be underestimates. The total number of cattle is said to have been in 1926 about the same as in pre-war days. This general impression clashes somewhat with the statistics of milk production, which show a diminution; but the fact that so many cattle are used as draught animals on French farms may explain the contradiction. The number of sheep, hogs, and horses diminished, for in 1926 they were respectively about a third, a fifth and an eighth less numerous in France than they had been before the war:

Year	Livestock[11] (In millions)			
	Cattle	Horses	Sheep	Hogs
1909–1913 (including Alsace-Lorraine)	15.1	3.3	16.7	7.4
1919	12.8	2.5	9.0	4.4
1920	13.2	2.6	9.4	4.9
1921	13.3	2.7	9.6	5.2
1922	13.6	2.8	9.8	5.2
1923	13.7	2.8	9.9	5.4
1924	14.0	2.9	10.2	5.8
1925	14.4	2.9	10.5	5.8
1926	14.5	2.9	10.8	5.8

The incompatibility between the diminution in the number of livestock and the enlarged area devoted to forage crops is more apparent than real. The fact is that, while much arable land was abandoned after the war to pasture, and some of it was given up to the production of fodder, the total annual forage crop yield was 6 or 7 per cent less (average 1923–1926) than before the war. Hay was no longer cut as often or cultivated as well as it had been.

Thus the production of such main crops as fodder and milk declined in France after the war. This was also true of peas, beans and wheat — but not of wine. Except for the year 1926 the vineyard output was well above the pre-war level. These contrary movements make it difficult to determine from a separate study of each crop exactly what was the general post-war trend of French agriculture. In order to overcome the difficulty, the annual movement of each of the crops mentioned above has been calculated as an index number on a base equal to the annual average production for the years 1909 to 1913, and these index numbers have been weighted and combined to form composite agricultural production index members:

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[11] Source: *Statistique Agricole Annuelle.* The pre-war data for Alsace-Lorraine were available for 1912 only, and they were taken from Office de Statistique d'Alsace et de Lorraine, *Comptes-rendus statistiques*, 1925, Nos. 4–5.

Year	*Index numbers of agricultural production in France and Alsace-Lorraine* [12]
1909–1913 (including Alsace-Lorraine)	100.0
1919	69.9
1920	70.8
1921	75.6
1922	87.1
1923	86.1
1924	95.9
1925	99.9
1926	82.1

The movement of agricultural output is inevitably irregular, because of its dependence on weather conditions which are generally different from year to year. Consequently it would be rash to draw any conclusions as to a definite trend from the data of so few years. Nevertheless, the fact that the average annual production from 1922 to 1926 was about 10 per cent below that of 1909–1913 is significant. What lends further importance to this decline

[12] For data, see *Statistique Agricole Annuelle.* The 1926 statistics were taken from the *Journal Officiel*, July 16, 1927; and the statistics of production for Alsace-Lorraine were communicated by the Office de Statistique d'Alsace et de Lorraine. Not all crops are included. The omission of meat was serious but could not be avoided because the data available were too fragmentary. Other crops omitted were flax, hemp, tobacco, hops, cocoons, garden crops, fruit, poultry, eggs, honey, straw and manure. Nevertheless the crops that were included may be regarded as sufficiently representative of the general movement, for they constituted in 1912 between 65 and 70 per cent of the total value of all agricultural production. The index numbers of each component crop were computed by dividing the production of any given post-war year by the annual average yield of the crop considered during the years 1909–1913. The relatives thus obtained were combined to form the composite agricultural production index number by averaging after weighting. The weights used were computed on the basis of the ratio of the average annual value of each crop during the years 1909–1913 to the value of all the crops considered, The value of the products of Alsace-Lorraine was assumed to be the same per unit of weight or volume as in France.

as indicative of a general tendency is the diminution in the area of arable land shown in the following table:

YEAR	ARABLE LAND	PERMANENT MEADOW AND PASTURE	UNPRODUCTIVE LAND
	(In millions of hectares)		
1909–1913 (including Alsace-Lorraine)	23.96	10.07	3.81
1919	22.02	10.55	5.02
1920	22.89	10.88	4.65
1921	22.98	10.93	4.59
1922	22.73	10.89	4.66
1923	22.97	10.93	4.75
1924	22.91	11.02	4.71
1925	22.74	11.16	4.75

The total tilled surface of France, which was almost constant from 1922 to 1925, was 7 per cent smaller than that of France and Alsace-Lorraine from 1910 to 1913. At the same time the land used for permanent meadow and pasture increased by 6 or 7 per cent, and the unproductive surface was 22 or 23 per cent more extensive than it had been before the war.

3. CAUSES OF THE DECLINE IN AGRICULTURE

In the course of the eight years immediately following the war, when industry not only recovered its pre-war productivity but was rapidly expanding, why did not agricultural production regain at least its pre-war standard? It might be thought, at the outset, that the fault does not lie with agriculture but with the statistics, which give a false impression because they include the devastated départements of the north, where recovery was exceptionally difficult and necessarily slower than in other parts of France. It is true, for instance, that the worked agricultural area of the ten invaded départements represented in 1924 93.5 per cent of the same area in 1913, while in the 77 remaining départements the proportion was 96.1 per cent. The meadow and pasture surface of the invaded region was in 1924 12.5 per cent larger than in 1913, while in the rest of France it had increased only 7 per cent. Moreover, the unproductive lands which had become 21.5 per cent more extensive in the uninvaded territory of France after the war, were 86 per cent larger in the war-stricken north. It is equally true that the number of cattle (−15.5 per cent in 10 invaded départements, −7.5 per cent in the 77 other départements), horses, pigs and sheep had diminished more in the invaded regions than elsewhere in France. Furthermore, the area devoted to forage crops shrank more in the invaded départements (−16.7 per cent) than in the other départements (−2.5 per cent). Curiously enough the reverse seems to be the case for wheat, for the wheat lands of the north, which are among the best in France, recovered a little better (85.1 per cent of pre-war wheat area) than the wheat lands of uninvaded France (82.4 per cent). It is seen, at once, that while the all-inclusive statistics may give an exaggerated impression of the decline in agriculture, the fact remains that even if the 77 uninvaded départements alone were considered French agricultural production would still be found below the pre-war level.

In seeking the causes of the post-war depression in French agriculture, it is well to inquire whether the same tendencies were in evidence also before the war, since most economic trends and changes have their roots reaching far back into the past. During the last quarter of the nineteenth century, the acreage devoted to the cultivation of cereals had already been diminishing. From 1900 to the outbreak of the war this area remained almost stationary. The land allotted to forage crops, on the other hand, had been increasing for 25 years up to 1913. In other words the tendency to use land less for cereal growing and more for fodder production had been in progress before the war, and the post-war period merely reveals the accentuation of a movement already under way. The increase in the amount of surface left idle is, however, exclusively a post-war phenomenon, for during the 25 years which preceded the outbreak of hostilities the area of uncultivated land had been diminishing.

Rural Depopulation

As it has already been observed, perhaps the principal cause of the diminution in cereal acreage and the corresponding increase in forage crop and uncultivated acreage was the progressive depopulation of rural districts resulting in a shortage of farm labor. The slow pre-war relative decline in rural population as compared with urban population, and the slight absolute decrease in the number of rural inhabitants, were singularly aggravated by the war. It is estimated that the population lost to agriculture in the course of hostilities amounted to about 1,200,000 (500,000 disabled and 674,000 dead and missing),[13] that is, to about one-eighth of the gainfully occupied agricultural population. Some of the men who were killed would have died in the normal course of events, even if there had been no war, but then young people would have grown up to take their place, and it was young men who formed the bulk of war casualties. Thus it was that the problem of rural depopulation became especially serious after the war, for the ensuing shortage of farm labor was detrimental to national production as well as to the interests of the employers of farm hands.

A comparison of the French population statistics of 1911 and 1921 reveals to what an appalling extent the rural districts suffered during the intervening decade which was marked by four years of war. France, exclusive of Alsace-Lorraine, had approximately 2,100,000 fewer inhabitants in 1921 than in 1911. Nine-tenths of this diminution took place in the rural districts, and only one-tenth in agglomerations of over 2,000 souls.[14] War losses, to be sure, accounted in no small measure for the depopulation of the countryside — but there were other causes too. For example, there was a declining birth rate, and also a marked migration of the population from the country to the city. Higher wages and better living conditions made urban and industrial centers more attractive than farms. Moreover, the inflation of the currency, which stimulated industrial development, may have intensified the movement of wage earners to the city.

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[13] Michel Augé-Laribé, *Le Paysan français après la Guerre*, p. 47.

[14] *Résultats statistiques du Recensement général de la Population, 1921*, Vol. I, Part I, p. 59.

Of the three causes of rural depopulation just mentioned, the war was the only new one, and its influence must not be exaggerated. Even in the decade from 1901 to 1911, when there was no war, although the total population of France increased by about 650,000 persons, rural population then diminished by 900,000 while urban districts gained 1,500,000. If the estimated rural war dead (674,000) be subtracted from the total diminution in rural population from 1911 to 1921 (1,977,000), then the loss to the countryside in that decade due presumably to causes other than the war amounted to approximately 1,300,000. The pre-war causes of rural depopulation were apparently gaining momentum year by year.

The movement of population from the country to the city is in modern times common to all nations whose industry is developing. *A priori* one would expect farmers to profit by such a contingency since it means a more intense demand for their products and a wider market. There are, however, offsetting factors such as imported foodstuffs from non-industrialized parts of the world which compete with home-grown produce, and the increasing scarcity of farm labor which results in higher labor costs for agricultural enterprises.

In France there are peculiar conditions which render these difficulties — otherwise universal to a greater or less extent — more acute than elsewhere. In the first place, since France has a stationary population, any shift from country to city means an absolute decrease in rural population. This resulted for France, as has been seen, either in a complete abandonment of lands except where machinery was found to take the place of men, or in a change of crops towards those requiring less labor.

There is, however, a feature in the farm life of France which tends to counteract the desertion of the countryside, and that is the fact that most farms — 70 per cent, according to the last estimate made (1892) — were owned by the farmers who worked them. It is generally thought that the 1892 estimate was too high, but it is agreed that the number of peasant proprietors was very large in comparison with the number of tenant farmers and agricultural employees. The statistics are difficult to interpret because it frequently happens that a man exploits his own land during certain seasons and works for some one else the rest of the year. Nevertheless it is estimated that the farm owners were a third more numerous in France than farm laborers. In all probability the advantages of urban and industrial life exercise a less potent attraction on peasant proprietors than on farm tenants and farm hands. Indeed it is frequently proposed that farm ownership should be encouraged by public measures in order to check the drift of population from the country to the city.

French agriculture would have been even more seriously affected by the diminution in farm labor, had it not been for the introduction of foreign labor. Even before the war France found herself compelled to encourage immigration. Between 1901 and 1911 the number of foreign-born increased by about 400,000, and undoubtedly a large number of these went to rural districts. In the post-war period, France leaned even more heavily on immigration. The preliminary reports of the 1926 census indicate an increase of more than a million foreign-born since 1921.[15] The estimates of the Ministry of Labor and Ministry of Agriculture give the distribution of these immigrants as about one-third to agriculture and two-thirds to industry. Since most of the immigrants were adults, the agricultural laboring population must have increased by nearly 300,000. Comparatively few of these newcomers acquired land of their own, for in 1921 there were only about 5,000 foreign farm-proprietors and 7,000 foreign tenant-farmers.[16] Consequently, the great bulk of the immigrants in the rural districts were in all probability wage earners. The agricultural wage-earning population having been, according to the 1921 census, 2,814,557 persons, it appears that immigration added about 10 per cent to this group in the five years that followed.

The question of population is thus at the heart of the agricultural problem of France. Nevertheless, population is not an autonomous factor in the life of a nation. Nor is it solely a matter of birth and death rates. While changes in the number of inhabitants powerfully affect the economic life of the country, they are themselves no less strongly affected by such economic phenomena as price changes, industrial development, business cycles and social conditions.

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[15] *Le Temps*, December 28 and 29, 1926. The foreign-born enumerated in 1921 were 1,550,459, and in 1926 they were 2,498,230. To the difference should be added 89,000 immigrants who had been naturalized between the two census years. Shortly after the 1926 census was taken, the 1926–1927 industrial depression set in, and a large number of foreign laborers returned to their native lands.

[16] G. Manco, "Les Étrangers dans les Campagnes françaises," in the *Annales de Géographie*, March 15, 1926, cited in the *Bulletin de la Statistique Générale de la France*, January–March 1927, p. 221.

Profits in Agriculture

Prominent among the causes of the decline in French agriculture and of the shift of population from rural districts to urban centers, were the low profits made by farm proprietors. According to an estimate made in 1912 bearing on the gross and net returns of capital invested in agriculture,[17] the current rate of profit was less

Crops	*Gross receipts of French agriculture, 1912*[18] *(In millions of francs)*
Cereals, grain	4,414
Cereals, straw	960
Grains other than cereals	105
Potatoes	1,133
Plants for industrial purposes	364
Annual forage crops	1,929
Natural meadow and pasture land	1,714
Vines	1,816
Horticulture, fruit and gardens	1,060
Woods and forests	300
Animals killed	3,890
Dairy products	1,500
Wool	50
Chickens, rabbits, eggs, etc.	700
Silk cocoons	22
Honey and wax	20
Total:	19,977

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[17] Michel Augé-Laribé, *L'Agriculture pendant la Guerre*, pp. 39–40.

[18] See note 16.

than one per cent. The gross receipts in the course of that year amounted to approximately 20 billion francs, as is seen in the table on the preceding page.

This table is of special interest not only because it reveals the huge total value of all agricultural products, which was about three times that of coal (676 million francs) or of iron and steel products (652 million francs), but also because it shows the relative importance of the separate items of farm production. This stupendous gross income was of little avail to the farmer, however, because the total expenses of production amounted to more than 19 billion francs:

Purpose	*Gross expenses of French agriculture, 1912* [19] *(In millions of francs)*
Taxes	762
Rent of land	2,750
Interest at 3% on working capital	540
Amortization of buildings	180
Amortization of agricultural material	320
Labor	6,000
General expenses, insurance, etc.	3,480
Interest on capital in seeds	23
Animal feed and straw	5,000
Fertilizers and interest on their value	150
Total:	19,205

The rent item in the above table was computed at the rate of 4.6 per cent of the land values, and the wages too were estimated at a low rate.

A comparison of the above two tables indicates an excess of gross receipts over gross expenses amounting to 772 million francs. This sum may be taken as representing the total interest on the agricultural investments which are itemized in the following table:

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[19] Augé-Laribé, *loc. cit.*

	Agricultural capital in France,[20] *1912* *(In millions of francs)*
Land	59,571
Buildings	10,800
Animals	7,350
Material	3,200
Seeds	950
Working Capital	8,000
Total:	89,871

In other words, these accounts show a return of three-quarters of a billion francs on a capital investment of 90 billion — which is less than one per cent. The absence of any similar estimate as to the return on capital invested in all French industries taken together makes comparisons impossible, but it is very probable that the return on industrial capital was considerably higher than 1 per cent. The individual French farmer does not operate on a good accounting system, and he generally thinks his profits greater than they actually are, because he fails to take into consideration all items of cost in the same way as industry does.

Wages in Agriculture

If agriculture proved to be unattractive even before the war to the farm proprietor because of the relative inferiority of earnings on investments, it was equally unattractive to the agricultural laborer because of the relatively low rate of wages prevailing on farms. M. Lucien March estimates that the average daily pay of the agricultural hand in 1914 amounted to about 3.5 francs (without food).[21] In that same year the average daily wage of surface and underground coal-mine workers was 4.94 francs; and the ordinary rate of pay in the small industries in the provinces was 5.07 francs in 1911. It must, of course, be borne in mind that living was more expensive in industrial communities than in rural districts, but still these data on wages as well as those on profits serve to explain in large part the appeal of the city to the country dwellers of France.

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[20] *Idem.*

[21] Lucien March, *Le Mouvement des Prix et des Salaires pendant la Guerre*, p. 250.

Farm Prices vs. Farm Costs

Another important fact which rendered the farm less attractive than the factory was the relative inferiority of the prices of farm products. During the war and after the war all commodities were affected by important price changes. It may be asked, then, whether the price of what the farmer sold went up more or less than the price of what the farmer had to buy. If the latter prices went up more than the former, it means that the French farmer's economic condition was becoming progressively worse under war conditions and during the post-war monetary crisis. In fact, were there adequate price data available showing that the French farmers' expenses were necessarily increasing more rapidly than their receipts during the period considered, there would then be revealed one of the fundamental causes of the low rate of profits in agriculture, of the farmers' inability to bring wages up to a level which would counteract the attractiveness of urban life to the worker, of the depopulation of the country-side — in short, of the whole decline in agriculture.

It is difficult to determine accurately what were the relative movements of the prices of industrial and farm commodities. The French wholesale price index number of the *Statistique Générale de la France* is computed, in part, from the prices of 20 agricultural products. Their rise and fall may be traced all the more easily because a separate index number is given for this category of commodities. There is, however, no corresponding separate index number for manufactured products. The industrial materials index number, which is made up of the price movements of 25 articles, is hardly comparable with the agricultural index number, because the former includes raw materials and imported products as well as articles manufactured in France. Furthermore, these industrial materials often constitute elements entering into the cost of production in certain industries rather than finished consumers' products. In the following table these two series of index numbers are set side by side:

WHOLESALE PRICE INDEX NUMBERS OF THE *STATISTIQUE GÉNÉRALE DE LA FRANCE*[22]

(Base: 1913 = 100)

Year	Foodstuffs	Industrial Materials
1913	100	100
1919	335	374
1920	459	552
1921	354	338
1922	324	330
1923	395	440
1924	451	520
1925	488	601
1926	631	762

Obviously the prices of industrial materials rose much higher than those of foodstuffs, but the disparate nature of the data involved would vitiate any definite conclusion.

A better way of investigating the position of the farmer with respect to post-war price movements would be to compare the costs of some important items in the farmer's expenses with the selling price of his principal products. Two important elements of the farmer's costs of production consist of payments for farm machinery and for fertilizers. The following table shows roughly computed index numbers of the prices of five types of agricultural machinery and five kinds of chemical fertilizers compared with the index numbers of the wholesale price of wheat, of the wholesale price of foodstuffs and of general retail prices prevailing in French cities of over 10,000 inhabitants, but not including Paris. The value of the last index number for this comparison rests on the fact that most of the items entering into its computation are foodstuffs.[23]

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[22] *Annuaire Statistique, 1925*, p. 207; *Bulletin de la Statistique Générale de la France*, January–March 1927, p. 132. The index numbers were converted from the base 1901–1910 to the base 1913.

[23] The prices from which the index numbers of prices of agricultural machinery and fertilizer were computed were taken from the semi-annual price quotations found in Michel Augé-Laribé's articles, "Agriculture," in the annual volumes entitled *La France économique* of the *Revue d'Économie Politique*. The prices were averaged but not

INDEX NUMBERS
(Base: 1913 = 100)

Year	Retail Price of Farm Machinery (5 types)	Retail Price of Chemical Fertilizers (5 types)	Wholesale Price of Wheat	Wholesale Food Prices	Retail Prices in Large Cities Other Than Paris
1924	467	396	386	451	408
1925	487	429	480	488	450
1926	573	628	683	631	571

Although, as it appears in the above table, farm machinery seems to have gone up in price a little more than farm products (except in 1926, which was a year of a very short wheat crop and of low steel prices), observers report that farmers bought more machinery, particularly smaller pieces, after the war than before 1914. This is explained by the shortage of labor which made such purchases necessary, and also by the fact that farmers ceased to invest their surplus funds in state bonds, finding a less hazardous outlet in farm machinery.[24]

The price of fertilizers apparently did not rise as much as the price of machinery except in 1926; and it appears also that the value of farm products kept pace, in general, with the advancing cost of artificial manures. One of the main reasons for the moderate rise in the price of fertilizers is the new favorable position of France in this respect. A number of the most important of the few potash beds of the world are found in Alsace. The greater post-war French metallurgical industry furnishes unprecedented quantities of slag fertilizer. Moreover, the excellent phosphate resources of North Africa are being constantly developed by the French. It is not astonishing, therefore, that the use of fertilizers should have increased after the war in proportions that are seen in the following table:

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weighted. The five items of farm machinery were: plows, sowers, mowing machines, fertilizer distributers, and threshing machines. The five fertilizers were nitrates of soda, phosphates, basic slag, sulphur and sulphates of copper.

[24] See above, p. 207.

INDEX NUMBERS OF THE CONSUMPTION OF FERTILIZERS[25]

	1913	1919	1920	1921	1922	1923	1924	1925
Superphosphates	100	55	91	72	95	111	114	112
Basic Slag	100	...	91	71	70	106	121	157
Nitrate of Soda	100	...	...	...	...	113	122	133
Sulphate of Ammonia	100	67	80	128	133	159	209	251
Calcium Cyanamide	100	94	96	107	114	365	360	390
Potash Salts	100	...	...	392	434	502	560	700
Copper Sulphate	100	...	...	...	...	112	129	116

Among the farmers' costs of production, wage payments frequently constitute an important item, though in France the small peasant proprietor does a good part of the work himself with the aid of his family, dispensing with almost all outside help. In a great many regions the supplementary help required is furnished by sons of neighboring farmers. It is chiefly the wheat-growers of the north and the owners of extensive vineyards in the south who employ large numbers of farm hands. For these big farms the post-war rise in wages presented very serious problems.

If M. March's figure of 3.5 francs per day in 1914 is taken as a basis of comparison, it is found that the farm laborer's daily wage computed in a similar fashion was 14.16 francs in 1924 and 14.73 francs in 1925.[26] Agricultural wages thus rose 4.1 times in 1924, while retail prices rose almost exactly to the same extent, wholesale food prices 4.5 times, and the wholesale price of wheat 3.9 times. In 1925 wages increased 4.2 times, while retail prices were 4.5 times higher, wholesale food prices 4.9 times higher, and the wholesale price of wheat 4.8 times higher. As these calculations contain a certain margin of error, due chiefly to the fact that the wage data available are for the years 1914, 1924 and 1925, while the price comparisons are based on the year 1913, it is very

[25] Source: *Annuaire Lambert-Rivière*, $6^{\text{ième}}$ fascicule, 1923–24–25. This is a commercial publication, and the figures are, therefore, not official.

[26] Source: *Bulletin de la Statistique Générale de la France*, January 1925 for the 1924 figure; the 1925 figure was computed from Compère-Morel's *Rapport fait au nom de la Commission des Finances chargée d'examiner le projet de loi portant fixation du Budget Général de l'Exercise 1927* (*Ministère de l'Agriculture*), pp. 18–27.

possible that the rise in wages corresponded pretty closely to the increase in the price of farm products and retail commodities. In 1924 the agricultural workers enjoyed perhaps a slight advantage over 1914 in point of real wages, but in 1925 when wages lagged behind retail prices (which rose sharply at that time), there was, in all probability, a small contraction of real wages. On the whole, therefore, it appears that the wage item in the farmer's expense account represented after the war perhaps a lower ratio in comparison with the price received for his products than before the war.

The farmer has not only to pay for machinery, fertilizers, labor, etc., but he also owes taxes to the State. Owing to the complicated French system of assessment of farm taxes by estimates,[27] it is impossible to tell precisely at what rate farmers are taxed, or to what extent this rate has increased in the post-war period. The very vagueness of the data has opened up a large field of current controversy as to whether the rural dweller or the city dweller has been harder hit by the post-war tax rise. There seems to be no doubt, however, that the amount of taxes paid by the French farmer in the post-war period increased proportionally more than the price received for his crop.

As the available evidence concerning the relative movement of the price received for farm products on the one hand, and costs of farm production on the other hand, is fragmentary and often contradictory, no definite conclusions may be drawn. What undermines still further the significance of the above data is the fact that neither the wholesale prices nor the retail prices of foodstuffs represent what the farmer really receives, and that the items of cost treated — wages, machinery, fertilizers and taxes — are not sufficiently comprehensive. The prevailing impression in France is that the farmer who gained most after the war was the small peasant proprietor who performed his own labor simply with the aid of his family. He saved on the wage item. The farmer, however — often unwittingly — made his greatest gain in saving rent or through the rise of rental values of his land, as will be seen in what follows.

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[27] *Cf.* Robert M. Haig, *op. cit.*

4. Land Values, Sales and Ownership

Under an accurate system of accounting the farmer should include among his annual costs either the interest on the value of his land, or its potential rental value. It would then become evident that this item did not rise as much as prices in general or as prices of agricultural products in particular. M. Caziot, a recognized authority on land values, has estimated that in July 1926, when the general wholesale price index number was eight and a half times that of July 1914, and when the foodstuffs wholesale price index number was seven times as high, French agricultural property was worth only two and a half times as much as before the war.[28] M. Michel has evaluated farm property, including buildings, for 1925 at about double its pre-war value,[29] while general wholesale prices had more than quintupled in the same interval. This lag in the rise of land values is not uncommon in periods of rising prices, and it is probably due to long-time rent contracts. It is, however, the opinion of those most familiar with French agricultural conditions that newly contracted rents rose somewhat more than prevailing land values.[30]

Another indication of the slow rise in rural property values after the war is to be found in the fact that the average size of mortgages in France was not much greater than in pre-war years. For 1923, 1924 and 1925 the average individual mortgage loans amounted respectively to 46, 48 and 35 thousand francs, whereas the average value of such mortgages in the years immediately preceding the war was 30 thousand francs. The total value of outstanding mortgages at the close of 1925 was 2.9 billion francs, which was only a little over .3 billion francs more than in 1913. In terms of gold francs the total mortgage loans not matured on December 31, 1925, were worth .7 billions as compared with 2.57 billions in 1913. This sharp decline in the gold value of outstanding mortgages was partly due to the urban rent restriction laws which kept down the value of real estate in the cities, but it was also due to the failure of rural land values to keep pace with the general price movement.

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[28] Pierre Caziot, "L'Agriculture," forming Chapter III in de Peyerimhoff *et alii*, *Les Possibilités économiques de la France*, p. 123. M. Caziot estimates the value of rural property, including forests, at 65 or 70 billion francs in 1914.

[29] L. Michel, *Journal de la Société de Statistique de Paris*, April 1925, quoted in Michel Augé-Laribé's article "La Production agricole et la Propriété foncière," *La France économique, 1925* (*Revue d'Économie Politique*, March–April 1926), p. 517. M. Michel estimated the total value of agricultural property, buildings included, at 72 billion francs in 1914, and 150 billions in 1925.

[30] Augé-Laribé, "La Production agricole et la Propriété foncière," *La France économique, 1924* (*Revue d'Économie Politique*, March–April, 1925), pp. 246–247.

The low increase in land values is, to a certain degree, in harmony with the capitalization theory. As the post-war rate of interest was, generally speaking, about twice as high as before the war, and rents remained almost stationary, on the basis of the capitalization of these respective returns, the value of land should have risen about half as much as general prices. There were, of course, other factors influencing rents, like the demand for land, rural depopulation, and declining net agricultural profits.

Post-war French agriculture was thus characterized by low rent charges and at the same time high working capital expenses. It might even happen that it cost the farmer more to buy the necessary circulation capital than to buy land. It is certain that the ratio between fixed capital and working capital was quite different after the war from what it had been before.

It is obvious that as long as low property values prevailed, French agriculturists had much to gain after the war by purchasing land or by coming into outright possession of it, if it were mortgaged. The extent to which mortgages were paid off after the war has already been discussed,[31] and it was seen that the current impression of a vast liquidation of these debts is probably exaggerated. There was, moreover, an important increase in the amount of new mortgages taken, which would indicate a rapid development of new purchases of land. In fact, the statistics of long-term loans made by rural credit organizations confirm the current opinion that in the post-war period a large number of former tenant farmers bought the lands which they had previously rented.

The various French rural credit banks make, in general, three categories of loans: short-term loans on crops; medium-term loans for purchasing cattle, machinery, etc.; and long-term loans for purchasing land. Their post-war development is noteworthy.

[31] See above, pp. 176–177.

RURAL CREDIT LOANS TO INDIVIDUALS[32]
(In thousands of francs)

Year	Short-Term	Medium-Term	Long-Term (Law of March 9, 1910)	Long-Term (Laws of 1918 and 1919)[33]
1910	66,957	......	864	......
1911	81,279	......	3,645	......
1912	84,691	......	3,609	......
1913	94,534	......	4,034	......
1919	....	....	......	1,201
1920	178,535	2,624	6,756	4,059
1921	108,905	4,782	15,512	6,978
1922	132,882	11,836	37,033	14,896
1923	172,648	20,346	44,452	20,162
1924	223,254	30,109	48,228	23,981
1925	287,673	49,230	45,270	22,471

The twelve-fold increase in long-term loans (law of March 9, 1910) from 1913 to 1924, when compared with the very much smaller increase (2.5 times) of the short-term loans in the same interval, though not constituting conclusive evidence, points nevertheless to a probable augmentation of the number of farm owners.

Further data indicative of a post-war development of farm land purchases are to be found in the statistics of the registration tax paid on sales of real estate. The principal weakness of this evidence lies in the fact that urban plots as well as rural farm lands are counted together in these figures. Still, in view of the post-war slump in city real-estate transactions, the registration tax statistics may be taken as having a close bearing on sales of rural property. Another defect of these data arises from frequent post-war augmentations in the rate of this tax, especially since the changes were made at times which did not coincide with the dates of the periodically published statistics of the amount collected. Nevertheless the data for 1919 and 1920 show that the value of the property sold was more than three times as high as before the war. As land values had gone up about 50 per cent,[34] it is probable that the amount of property involved in the transactions of 1919 and 1920 was about double that which changed hands before the war in a similar period.

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[32] Source: *Journal Officiel.* These figures include only loans granted by state-aided rural credit banks.

[33] The laws of April 9, 1918 and October 23, 1919 made provisions for facilitating the acquisition of small holdings by war veterans and war widows.

The increase in the number of land transactions was without doubt due in part to the postponement of purchases and sales during the war, and also to the death of owners killed in the course of hostilities. Moreover, not every sale resulted in the acquisition of farm lands by a purchaser who was to exploit them personally. Frequently the new proprietors, like their predecessors, left the farm to be worked by old tenant farmers. It is notorious indeed that often French peasants, who are famed for their capacity to save and for their eagerness to buy agricultural property, satisfied their "land hunger" only too well by purchasing more land than they could eventually work, since it was easier for them to pay for the land than to cover the costs of machinery, buildings, fertilizers, labor, etc. Nevertheless when all due allowance has been made for these various circumstances, the fact remains that statistical evidence, current opinion, and *a priori* impressions all point to an augmentation of farm land proprietorships after the war.

Rural Credit

One of the pieces of evidence adduced to show the post-war increase in the number of purchases of land consisted in the vast development of borrowings from rural credit banks. A boom in land transactions involves an almost equal expansion in credit transactions. It does seem strange, however, that the farmer should have been able to obtain abundant loans — and long-term loans at that — in the post-war period, at a time when the credit situation in general was extremely difficult, characterized by prohibitively high rates of interest, by an appalling scarcity of capital, especially during 1924, 1925 and 1926, and by a marked tendency to keep fluid what capital there was.

It would normally be expected that agriculture would be as

[34] Augé-Laribé, *Le Paysan français après la Guerre*, pp. 80–81.

much affected by this situation as industry. To a certain extent it was, for one of the reasons why land values rose less than other values was the existence of high rates of interest.[35] The farmer's credit difficulties were, however, very much attenuated as a result of the aid given by the State to rural credit institutions.

The system of state aid was inaugurated by the law of March 31, 1899. Before that time, the farmer or his coöperative business organizations, when in need of a loan, had to resort to the usual credit institutions available to society in general. There had been, besides the ordinary commercial credit banks, the *Crédit Foncier de la France* (a bank specializing in first-mortgage land loans) and sporadic rural mutual credit associations. All of these had proved unsatisfactory, either because their terms were too onerous or because they did not have adequate funds. Therefore the State decided in 1899 that the royalties paid annually by the Bank of France to the State Treasury should be placed under certain conditions as a loan without interest at the disposal of the regional rural credit organizations (*Caisses régionales de crédit agricole mutuel*). The original law of March 31, 1899, was later modified by the law of December 29, 1906, giving rural coöperative associations credit at reduced interest through the agency of the regional organizations; by the law of March 19, 1910, facilitating the acquisition of peasant proprietorships through grants of long-term credits to individuals; and by the laws of April 9, 1918 and June 21, 1919, extending special advantages to war veterans and other victims of hostilities. Finally, a law was passed on August 5, 1920, consolidating and reorganizing the system of state-aided credit which had been developing during the previous quarter of a century.

At the base of this system there are the local rural credit organizations (*Caisses locales de crédit agricole*) — about 5,300 in number — which are, in reality, made up of the banking departments of the numerous local farmers' syndicates (*syndicats agricoles*) of France. They are mutual credit associations where members deposit their surplus funds for which they receive interest, or borrow money on easy terms whenever they require it. Above these local associations are 98 regional credit organizations (*Caisses régionales*

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[35] See above, p. 496.

de crédit agricole), which act principally as banks for the local organizations. And finally, at the apex of this system is the national bureau of rural credit (*Office national de crédit agricole*), an autonomous state organization, the functions of which had previously been performed by a division of the Ministry of Agriculture. It is the national bureau that receives directly from the State grants of credit that eventually filter through to the regional and then to the local organizations.

The extraordinary development of rural credit of the state-assisted type was due partly to the improvements in organization effected by the law of 1920 and especially to the increase in the advances received from the State. These grants of credit consisted not only of royalties from the Bank of France, but also of a certain percentage of the Bank's profits.[36] With the increase in monetary circulation, therefore, and with the growth of the profits of the Bank of France there was a swelling of funds at the disposal of the state-aided rural credit associations. That these grants-in-aid from the State were principally responsible for the increase in rural credit activity is seen by the fact that funds derived from other sources, that is, from deposits made by members of the mutual rural credit organization and others, did not increase to anything like the same extent (see table on page 501).

The farmer profited not only by the abundance of capital which state aid placed at his disposal but also by the fact that the legal regulations of the rural credit associations allowed him to avail himself of this capital on particularly easy conditions. The rate of interest on long-term loans made by the above associations was invariably 2 per cent up to the middle of 1927, when it was raised to 3 per cent. If this rate be compared with the 8 per cent required by the *Crédit Foncier*, then the extent of the extraordinary advantages offered by state-aided rural credit banks becomes clear. As for the interest on short-term loans, only a maximum rate was

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[36] By the financial law of December 19, 1926, only five-sixths of the sums received by the State from the Bank of France were to go to the rural credit systems, the rest being destined for the State Treasury to cover general budget expenses. It was also stipulated in the same law that when the amounts received exceeded 115 million francs, the surplus was to be divided evenly between the Treasury and the national bureau of rural credit.

Year	*State advances for rural credit*[37] (*In millions of francs*)	*Private funds for rural credit*[38] (*In millions of francs*)
1910	11	59
1911	18	70
1912	14	77
1913	12	91
1920	28	177
1921	87	78
1922	87	133
1923	125	161
1924	125	226
1925	160	286

fixed: it was never to exceed the discount rate of the Bank of France by more than 1 per cent. Below this upper limit, however, the rates might vary from département to département according to the local money market situation. Before the war the prevailing rate was between 3 and 4 per cent; after the war it was generally 5, 5.5 or 6 per cent.[39]

It was inevitable that at such low rates of interest state-aided and state-controlled rural credit should have been very popular with French agriculturists after the war.[40] At the same time, it is to be observed that farmers continued to deposit their surplus funds with rural credit associations in considerable quantities, despite the fact that the rate of interest paid on such deposits was limited by law to 6 per cent and that higher interest was being paid elsewhere. Without doubt the impression of greater security in a state-controlled institution was largely responsible. All the circumstances served to strengthen the state-aided mutual rural credit organizations and thereby to encourage purchases of small farms and the development of agricultural coöperative associations.

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[37] *Rapport sur les Operations faites par les Caisses régionales de Crédit agricole mutuel pendant l'année 1925*, p. 4.

[38] Computed by subtracting the state advances from the total loans. On p. 497 a table of loans to individuals only was given, but agricultural coöperation profited also by the state-aided rural credit system.

[39] Source: Annual reports of the Office National du Crédit Agricole.

[40] The state-aided rural credit banks were not the only institutions to which farmers applied for loans. There was also the Crédit Foncier, mutual credit organizations not aided by the State and other sources of loans.

Farmers' Syndicates

The expansion of state-aided rural credit facilities in France went hand-in-hand with a remarkable growth of farmers' organizations. This coincidence was only natural in view of the fact that the local rural credit organizations were closely bound up with the local farmers' syndicates known as *syndicats agricoles*. The progress achieved by these syndicates in the post-war period was manifested by their increase in number and membership:

AGRICULTURAL SYNDICATES AND THEIR MEMBERSHIP [41]

Year	Number of Syndicates	Membership (In thousands)
1913	6,178	976
1920	6,519	1,084
1922	7,654	1,150
1923	8,260	1,188
1924	8,633	1,205
1925	9,941	1,223

There were, thus, about 25 per cent more members in 1925 than in 1913. About half of this increase occurred from 1913 to 1920, so that the rate of growth in the five-year period that followed was of 13 per cent. This does not compare very favorably with the 30 per cent increase in membership in the quinquennial period from 1905 to 1909, or with the 25 per cent increase from 1909 to 1913. Nevertheless, it was to have been expected that, as an organization of this type grew, its rate of accretion in membership should diminish. The number of syndicates, however, augmented with greater rapidity, for they were about 39 per cent more numerous in 1925 than in 1920. The rate of increase in this respect was about the same as from 1909 to 1913.

The general idea of organization among agriculturists is very

[41] *Annuaire Statistique, 1926*, p. 47.

old in France. The modern *syndicat agricole*, however, dates from 1884 when the law authorizing its existence was passed. This same law permitted the formation of unions of local syndicates on a départemental and regional scale, better able to cope with the larger problems confronting the French farmer.

The functions which these *syndicats agricoles* perform are indeed manifold. Just as they vary in size, so they frequently vary widely in their aims. Most of them have given from the very beginning a more or less important place to solving the rural credit problem, and it was out of this effort, as has just been seen, that the State-aided local rural credit institutions arose. Another very common object of the syndicates, even in their earliest days, has been to engage in coöperative purchasing of machines, fertilizers, seeds, etc., for by larger scale purchases they could buy more cheaply and also protect themselves better against fraud. Coöperative selling entered considerably later — around 1896 — for while every member stood to gain in coöperative buying, selling in common often conflicted with the individual interests and so was much more difficult to organize. Furthermore, it required a standardization of the products offered for sale. When once under way coöperative selling proved to be a big step forward in attenuating the farmers' marketing difficulties. Coöperative production was developed by the syndicates as a corollary to coöperative selling. This scheme was particularly useful to the small wine-grower and dairy products farmer, for he could elaborate his product under more favorable conditions at the coöperative wine-press or creamery.[42] The départemental and regional unions of these syndicates — whatever their objects — have performed an important function in facilitating the coöperative activities of the syndicates, because they could command more capital, make purchases in larger quantities and under more favorable conditions, and chiefly because they possessed more adequate information concerning prices and markets.

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[42] According to an incomplete census taken by the Office du Crédit Agricole in 1925, there were in all between 3,500 and 4,000 syndicates for coöperative production, of which 239 were wine-growers' coöperatives, 1,827 diary products coöperatives, 175 distillery coöperatives, 598 coöperatives for the utilization of agricultural machinery, 428 coöperative baking syndicates, 36 coöperative oil press syndicates, etc. Cf. Augé-Laribé, *Syndicats et Coöperatives agricoles*, pp. 94–95.

5. THE PROBLEM OF SELF-SUFFICIENCY WITH REGARD TO FOODSTUFFS

The growth of farmers' syndicates, the amelioration of rural credit, and the relative cheapness of farm lands all served to check the decline of French agriculture. Nevertheless, when all due allowances are made for changing weather phenomena, unstable prices, and other temporary conditions affecting crop yields, it is seen that, generally speaking, the trend of agricultural production from pre-war to post-war years was downward. The seriousness of this situation can be judged only in the light of the demands for the products of agriculture; and the increasing or decreasing adequacy of French farm production to satisfy domestic requirements is best reflected in the statistics of foreign trade in foodstuffs.

In the post-war period France imported more foodstuffs than she exported. In 1927, the value of this category of imports amounted to 13.9 billion francs, while the exports were worth 5.4 billions. The difference in weight was even greater: 6.6 million tons for imports and 1.4 million tons for exports. It is clear from these figures, as well as from a detailed analysis of the foreign trade figures, that France tends to import bulky foodstuffs and to export lighter manufactured foodstuffs embodying more value per unit of weight. In so far as the French dietary habits are following an almost universal trend, especially manifest in the United States, of shifting from a cereal and starchy food base to a herbivorous one (made up principally of salads), the problem of self-sufficiency with regard to foodstuffs may eventually be solved. On the other hand, it is highly doubtful whether such a solution is desirable from the point of view of the French agricultural interests, which require an intensified demand for products involving the use of more soil. Greater self-sufficiency may be bought only at the price of an intensified agricultural crisis.

The greatest single item of the various foodstuffs introduced was cereals which represented, in 1927, 48 per cent of the weight and 33 per cent of the value of all foodstuffs imported. It is, therefore, of primary interest to examine the import and export movement of this commodity.

FOREIGN TRADE IN CEREALS[43]
(In thousands of tons)

YEAR	IMPORTS	EXPORTS	NET IMPORTS
1909–1913 (average)	2,132	57	2,075
1919	3,163	34	3,129
1920	3,570	196	3,374
1921	1,722	194	1,528
1922	1,636	110	1,526
1923	2,243	150	2,093
1924	2,290	151	2,139
1925	1,940	52	1,888
1926	1,312	82	1,230
1927	3,138	59	3,079

The striking feature of the above table is the diminution in the amount of imports from 1924 to 1926. Does this indicate that France was coming nearer to the point of self-sufficiency in cereals than she had been even before the war? Hardly, for the 1927 figure reveals a recrudescence of extraordinarily large wheat imports.

One must exercise great caution in answering a question of this nature, for fluctuations in agricultural production, exports and imports, over so short a period, are too subject to accidental and ephemeral influences to allow of any conclusive interpretations. In view of the fact that the average annual quantity of cereals produced in 1924–1926 was still 14 per cent below the pre-war yield, it would seem that the decline in imports in the latter post-war years was due to a restriction in demand rather than to an abundance of home supply. In fact, the per capita consumption of cereals in France fell by about 12 per cent from the five-year period immediately preceding the war to the period extending from

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[43] Designated in French foreign trade statistics as "céréales (grains et farines) y compris le malt." Alsace-Lorraine was included only in the post-war figures. It is possible to estimate roughly the pre-war imports of France and Alsace-Lorraine, however, given the production data of France, 15.8 bushels per capita of population and of Alsace-Lorraine, 12.1 bushels per capita, for the years 1909–1913. Assuming that the per capita imports of Alsace-Lorraine were greater to the same degree that the per capita production was smaller, the total imports of France and Alsace-Lorraine may be computed at an annual average of 2.2 thousand tons for 1909–1913.

1922 to 1926.[44] The cause was probably the rising price of grain, which was accentuated in France by the fall of the franc.[45]

If consumption be computed as equal to production plus net imports, then before the war the domestic yield of cereals satisfied from 89 to 92 per cent of French requirements.[46] During the years 1922–1926 the ratio between production and consumption in a similar way was 89.5 per cent. Had the per capita consumption of cereals in the post-war period been the same as before the war, then this ratio would have been much lower. Another reason why the figure 89.5 per cent may be regarded as too high and as unrepresentative of any permanent post-war ratio between production and consumption, is found in the fact that the yield per acre of cereals was exceptionally high from 1922 to 1925,[47] owing to unusually favorable meteorological conditions in those years.

Since wheat represents a proportion varying between two-thirds and three-quarters of all cereals imported, it is important to ex-

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[44] *Annuaire Statistique, 1926*, p. 127.

[45] That the rising price of cereals in France, and especially of imported cereals, was not an exclusively French phenomenon, nor one due solely to French inflation, may be seen in the following table:

YEARLY AVERAGE PRICE OF CEREALS

Source: International Institute of Agriculture, *International Yearbook of Agricultural Statistics*, for 1925–1926.

MARKET AND CEREAL	1913	1921	1922	1923	1924	1925
Chicago Wheat, No. 2 Winter, cents per bushel	90.25	141.38	121.50	112.38	125.88	166.00
Buenos Aires Wheat, current pesos per quintal..	8.65	16.28	12.52	11.99	13.28	15.55
Minneapolis Rye, No. 2 cents per bushel......	56.63	114.13	83.25	69.63	85.25	107.50
Chicago Maize, No. 2 Mixed, cents per bushel	64.25	58.25	63.00	82.63	97.25	103.65

[46] For the years 1909–1913 the production of cereals amounted to 17,317,600 tons and net imports to 20,075,000, making production 98.4 per cent of consumption. According to M. Augé-Laribé's estimates the domestic production of wheat, maslin, oats, barley, rye, maize and buckwheat for the years 1904–1913 represented 92.3 per cent of production. *Cf.* Michel Augé-Laribé, *L'Agriculture pendant la Guerre*, p. 35.

[47] See above, p. 476.

amine in detail production and foreign trade in wheat as indicative of the tendency toward or away from self-sufficiency in foodstuffs. It has been estimated by M. Augé-Laribé that during 1904–1913, 93.1 per cent of the wheat consumed in France was grown within the country.[48] What was the percentage for the last few years of the post-war period, at a time when agriculture might be expected to have recovered completely from the effects of the war? On the assumption again that production (an annual average of 76.5 million quintals for the years 1924–1926) plus net imports (an annual average of 9.6 million quintals for 1924–1926) equalled consumption, France produced 88.9 per cent of the wheat she consumed in the latter years of the post-war period. With respect to wheat, then, France had fallen behind her pre-war standard of self-sufficiency.

This decline is all the more significant because the yield per acre in wheat was considerably above the pre-war average in 1924 and 1925,[49] though the shrinkage in wheat area led to a smaller total crop. In so far as the relatively rich harvests from 1923 to 1925 may have been due to improved methods of cultivation, better use of fertilizers and the abandonment of some of the worst lands, a higher standard of production may be expected to continue. But that favorable atmospheric conditions constitute an important element is indicated by the fact that in 1926 the yield per acre dropped below the 1909–1913 average. If the yield per acre had been the same during 1924–1926 as during 1909–1913, the average annual production would have been 72.6 million quintals, representing only 84.3 per cent of consumption; that is to say, France would have fallen still further behind her 93.1 pre-war ratio of production to consumption.

The per capita consumption of wheat (including that used for seeding) declined from 245 kilograms per year during the decade 1904–1913 to 211 kilograms during the years 1924–1926. This would seem to indicate that other foods like rye, potatoes, meat, fruit, and sugar were perhaps eaten in larger quantities. This, however, was not always the case, as will be seen.

With regard to rye, there was a decrease both in production from 13.1 million quintals per year for the decade before the war to 9.7 million quintals per year during 1924–1926, and in apparent consumption from 13.3 million quintals (including seeding) to 10.1 million quintals. The population of France had increased very little in the interval, and it may safely be said therefore that the per capita consumption of rye diminished to about the same degree as the total consumption. The ratio between production and consumption in 1924–1926, which amounted to 96 per cent, compared unfavorably with the ratio of 98.5 per cent for 1904–1913.

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[48] Michel Augé-Laribé, *op. cit.*, p. 35.

[49] See above, p. 476.

Potatoes were apparently no exception to the general rule — the total and per capita consumption of this product declined too. From 1904 to 1913 total consumption amounted to 133.2 million quintals on the average per year, while from 1920 to 1926 it amounted to 120.3 million quintals.[50] The per capita consumption declined from 339 kilograms per year before the war to 295 kilograms after the war, representing a diminution of about 13 per cent. In the ten-year period from 1904 to 1913 production of potatoes exceeded domestic requirements, so that 8.7 per cent of the yield was exported, while in the seven years from 1920 to 1926, production and consumption just barely balanced.

The decrease in the per capita consumption of all cereals in general, and of wheat and rye (the principal ingredients of bread) in particular, would lead one to expect a compensatory increase in the per capita consumption of meat. The enlarged acreage devoted to forage crops and pasture lands makes such an expectation all the more logical. Unfortunately, there are no statistics available concerning either the production or the consumption of meat. Only foreign trade figures exist, and these show an important increase in imports. The net imports of meat in 1913 (not including Alsace-Lorraine) amounted to 28.4 million kilograms, while after the war (including Alsace-Lorraine) during 1922–1926 the average annual net imports of meat attained the figure of 160.4 million kilograms.[51] In other words the net imports per person rose from .71 kilograms in 1913 to 3.93 kilograms in the post-war years.

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[50] The extremely wide fluctuations from year to year both in production (see above, p. 477) and in foreign trade of potatoes made it necessary to choose a wider period than the 1924–1926 period previously used for comparisons with pre-war years.

[51] These foreign trade figures include meat on the hoof.

This fact, in addition to the augmented area for feeding cattle, would certainly lead to the presumption of an increased consumption of meat in France.

In 1925 a study of meat production and consumption was published by the United States Department of Agriculture.[52] It was estimated that the consumption of beef, veal, mutton and pork per capita in 1924 was 115 pounds avoirdupois as compared with 112.4 pounds avoirdupois in 1912. Since the net imports per capita amounted to about 1 pound avoirdupois in 1912 and to 9 pounds avoirdupois in 1924, it would seem that while domestic production satisfied 99 per cent of the demand for meat before the war, in the post-war years it met only 92 per cent of this demand. These are, however, very uncertain estimates.

Other indications of meat production are found in the livestock figures and the abbatoir statistics. In 1926 the number of cattle in France and Alsace-Lorraine was only 4 per cent below the pre-war standard for the same area. The number of hogs was, however, 22 per cent below the standard, and the number of sheep 36 per cent below.[53] These figures do not necessarily imply a diminished annual meat production, for by improving methods of breeding and by slaughtering younger animals, the ratio of meat produced to livestock might very well have been increased. Nevertheless, in view of the very large drop in the number of hogs and especially of sheep, it seems that domestic production after the war must have fallen short of the pre-war level. This impression is borne out by the slight decline in the abattoir output. Nevertheless, allowance must be made for the fact that after the war there was a decentralization of the slaughtering industry — that is to say, more animals were killed in smaller places and thus escaped enumeration in the abattoir statistics. This is in harmony with the opinion that there was an increase in the consumption of meat in the small towns and in the rural districts of France, which was coincident with a decrease of meat consumption in the cities.[54]

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[52] *Foreign Crops and Markets*, Reports of the Department of Agriculture, Washington, D. C., April 13, 1925.

[53] See above, p. 480.

[54] In Paris the per capita consumption of meat fell from 67.6 kilograms in 1913 to 63.2 kilograms in 1924. These estimates are based on statistics of total consumption

In the post-war period a new factor seriously affecting the meat situation made its appearance. That was the development of the technique of refrigeration, which resulted in an important expansion of trade in refrigerated meat. Though the French claim to prefer fresh to frozen meats, the imports of the latter increased from 38 million kilograms in 1922 to 57 million in 1927. The relatively low prices of the imported refrigerated product acted as an effective check on domestic meat production.

It is not possible in all cases to indicate clearly the shift from one foodstuff to another in French consumption, nor to estimate the ratio of domestic production to consumption. Thus far it appears that the consumption of cereals and potatoes declined after the war, and that the consumption of meat increased slightly, if at all. It might also be said that for all these products domestic production in the post-war period was about a tenth below the pre-war production of France.

The decline in self-sufficiency is further indicated by the fact that the net annual imports of vegetables and fruit were fourteen times greater in 1922–1926 than in 1909–1913. Moreover, while France before the war practically covered her demand for sugar with her own production, in the post-war period the net annual imports averaged about 311 thousand tons. There was, on the other hand, a general tendency for the net sugar imports to diminish during the successive post-war years as the devastated sugar beet area was reclaimed and the war-shattered refineries were reconstructed. Nevertheless, the statistics showing that the per capita consumption of sugar was greater in 1920, 1922, 1923 and 1924 (the last estimate available[55]) than in any year before the war, lead to the conclusion that the greater dependence of post-war France on sugar imports was not wholly due to invasion and destruction during the war. Even in the case of wine — one hardly suspects that a country with so widespread a reputation for wine as France has been importing more than she exported

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of meat in Paris (196,469 thousand kilograms in 1913 and 182,089 thousand in 1924) reported in *Special Circular 144*, Department of Commerce, Foodstuffs Division, Washington, D. C.

[55] *Annuaire Statistique, 1926*, p. 129.

ever since 1880 — France declined in self-sufficiency from a 91.5 per cent ratio of production to consumption in 1904–1913 to an 89.6 per cent ratio in 1922–1926. It does not follow that domestic production declined, for, on the contrary, it increased. The larger imports were due principally to a 30 per cent greater per capita consumption of wine in 1922–1926 as compared with 1909–1913.

Still another element unfavorably affecting the agricultural self-sufficiency of France was the development of a popular taste for exotic fruits and products. The imports of certain tropical products, like coffee, cocoa, tea, vanilla, and pepper increased about 50 per cent from 1909–1913 to 1922–1926. Also bananas, oranges, lemons, tangerines and pineapples played a greater part in the post-war French imports than ever before.

Only in respect of dairy products, among all the principal agricultural commodities, did France maintain her status of self-sufficiency with an excess of products for export. As is seen in the following table, it required several years after the close of hostilities to recover from the effects of the war:

Year	*Net exports of milk, butter and cheese* (*In thousands of tons*)
1909–1913 (average)	14.1
1919	−39.5 [a]
1920	−37.0
1921	−35.9
1922	−49.2
1923	−9.6
1924	19.4
1925	4.9
1926	12.7
1927	5.1

[a] Minus sign = net imports.

It is obvious, then, that France during the post-war period was far more dependent on foreign countries for foodstuffs than she had been before the outbreak of hostilities. From a nationalist standpoint the picture is a gloomy one, for it is often maintained that in the event of war the country will be in a perilous position, since the French fleet may not be strong enough to ensure the importation of an adequate food supply. It is only natural, therefore, that the State should take a keen interest in ameliorating the agricultural situation of the country.

Agriculture and the State

One relation between the State and agriculture has already been touched upon in the discussion of rural credit. There are many other ways in which the State aids, or at any rate attempts to aid, agriculture. By its policy of protective tariff inaugurated in 1894, for example, it undertook to shelter the French farmer from the dangerous competition which was making itself felt through the second half of the nineteenth century as cheaper foreign agricultural products poured into the country. It is quite impossible to determine exactly the wisdom of this policy. Without doubt farmers working on a marginal basis were encouraged by this measure, but the opponents of protective tariff argue that the elimination of outside competition took away the stimulus towards improved methods. In fact, the history of French agriculture from 1894 to 1914 does not reveal as much progress in agriculture as the agricultural reformers wished to see. Although the yield per acre of wheat increased by 14 per cent from 1884–1893 to 1904–1913, there was a slight diminution in total acreage.

In the post-war years the measures of protection for agriculture were considerably attenuated, if not as a matter of deliberate policy, at least by the force of circumstances. Since most French duties were specific and not *ad valorem*, they soon lost their effect as the franc fell in value. The Government found it necessary, therefore, to raise the old tariff rates, and in the administrative measures taken to maintain the *status quo*, it seems that agriculture was discriminated against. As M. Augé-Laribé put it: "Thus for industry the old (pre-war) rates were multiplied by 4 and increased on two successive occasions by 30 per cent. For agriculture the old rates were maintained or doubled — nominally — and increased on only one occasion by 30 per cent." [56] Furthermore an absolute prohibition was placed on the exportation of some important agricultural products, while on others an *ad valorem* export tax of 25 to 40 per cent was imposed. In addition, the tariff rates on many products, notably on wheat, were changed rather frequently — leading to an unsatisfactory state of instability.

Whether this general discrimination really favored industry, as was probably intended, may be questioned. Factory employers and industrial agglomerations are naturally interested in keeping the price of food as low as possible. At the same time they are no less interested in the prosperity of the rural population, which constitutes so important an outlet for manufactured goods. Especially in France there is a need to develop the home market in order that the products of the over-equipped steel, metal trades and textile industries may be absorbed.

Education is another means by which the State endeavors to encourage agriculture. Both before and after the war the State sought to increase agricultural output by disseminating knowledge of improved methods of cultivation, for it has long been recognized that the output of foodstuffs can be enormously enlarged if farmers are skilled in such matters as the selection of seed, the breeding of stock, the proper use of fertilizers, the best ways of fighting parasites, the keeping of accurate accounts of expenditures and income, etc. It is notorious that the French peasant is sadly behind the times in most of these departments of agricultural knowledge. The task of educating the farmer and the young who are destined to devote their lives to agriculture is all the more difficult, because those who most need such education live in relatively isolated districts, and their isolation renders them conservative, individualistic and very resistant to the assimulation of new methods of production.

The backwardness of France in agricultural education before the war is seen in the following figures:[57]

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[56] Michel Augé-Laribé *et alii*, *Agriculture*, Les Cahiers du Redressement Français. No. 5, p. 6.

[57] *Ibid.*, p. 42.

Country	*Agricultural schools* (*1910*)	*Pupils* (*1910*)
Germany	1,708	70,362
Belgium	70	5,000
Denmark	99	9,561
France	71	2,200

Even before hostilities ended the French Parliament adopted a general measure to remedy the situation. The law of August 2, 1918, later completed by a series of administrative decrees, provided, among other things, for the organization of winter schools, ambulant courses, changes in the curriculum of rural elementary schools, and supplementary instruction of children graduated from these schools. The law and its attendant decrees were, however, hardly more than projects, the realization of which depended upon the financial support given by local authorities and the instructors available in each place.

Important work was accomplished after the war by the advanced schools of agriculture, such as the *Institut National d'Agronomie*, the three national agricultural schools at Grignon, Montpellier and Rennes, and the *École Nationale d'Horticulture* at Versailles. Practical training was given in the dairy schools at Mamirolle, Surgères and Poligny, and in the national school of agricultural industries at Douai.

The so-called winter schools, started in 1902, and stimulated by the law of 1918, achieved considerable success after the war in popularizing agricultural information. These schools were attached to the ordinary lycées, normal schools and colleges, the courses being given from November to March. The ambulant courses, inaugurated before the war, were held in one rural district after another, also from November to March. These together with the post-school courses, begun in 1918, offered a rather meager educational program consisting of a little reading, writing, discussion, an occasional moving-picture on agricultural subjects and a certain amount of demonstration work. The merit of these institutions lay chiefly in the possibility of their future development and extension.

Although the organs of elementary agricultural education were still in a rudimentary state after the war, the needs of advanced students appear to have been better cared for. The attendance in the schools of higher agricultural learning increased considerably. Whereas the number of students in all agricultural schools of France in 1910 amounted to only 2,200, and in 1918 had fallen to 2,000,[58] in 1925 there were 1,762 students in the practical schools of dairying, etc., alone, and 808 students in the national schools and in the *Institut National Agronomique.* Unfortunately, no statistical data are available in comparable form concerning attendance in the lower schools and special courses.

The depreciation of the currency proved to be a serious obstacle in the way of the development of post-war agricultural education. The budget for this kind of instruction increased from 4.8 millions in 1913 to 15.1 millions in 1926,[59] that is to say by little over 300 per cent, which was not at all adequate compensation for the depreciation in the purchasing power of the franc. Moreover, the proportion of the budgetary appropriation for agricultural education to the total budget was but half of what it had been before the war. The financial support given by the French State compared unfavorably with the amount spent for the same

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[58] Compère-Morel, *op. cit.*, p. 113.

[59] This budget includes a small item for inspection (about 2 or 3 per cent before the war and a little more in the post-war years), but does not include veterinary instruction which is given apart in the following table:

BUDGET FOR AGRICULTURAL INSTRUCTION

(In francs)

These figures were taken from the budget reports of the Ministry of Agriculture, and the separate items represent budgetary grants and not actual expenditures. For the last year, only the amount requested was reported.

Year	Agricultural Instruction (including inspection)	Veterinary Instruction
1912	4,582,567	1,167,300
1913	4,789,930	1,302,850
1919	7,402,760	1,935,865
1925	15,212,930	4,068,650
1926	15,100,200	4,025,200

purpose by the neighbors of France lying to the north and to the east.

Undoubtedly the part played by the French State in agriculture during the post-war years was extremely important. Its assistance in matters of credit not only stimulated the acquisition of land by small farmers, but went hand in hand with the industrialization of agriculture and aided the farmer in purchasing new working capital of a more expensive kind than had ever been used before. The widening of the educational program was particularly necessary after the war, at a time when small farmers were buying up more land and were in need of more knowledge of the best ways of exploiting the soil. State aid required to be intensified in the old channels and also to be carried further afield. Better rural roads, a wider extension of electricity, more efficient postal, telephone, and telegraph service: these were things that farmers asked of the State. And the farmers formed organizations to attain these ends as well as to clamor for higher protective tariff.

Social Progress

Up to the present farmers have been considered only as productive agents, but it must not be forgotten that they are also human beings. Their comfort and happiness are of intrinsic importance. At the same time rural social welfare is not unrelated to productivity. The wholesale migration to cities and factories, and the consequent depopulation of the countryside, were not only matters of wage scales, but were also a result of the greater attractiveness of social life in industrial communities. It is no wonder that agricultural laborers deserted more inaccessible regions of poorer lands, where the inventions and customs of the modern age hardly penetrated at all. The rural housing conditions, which had been most deplorable before the war, left much to be desired in the post-war period. Although it is reported that there are fewer peasants and farm hands sleeping in barns without bedclothes, the situation was still such that the French Chamber of Deputies rose up in righteous indignation about it and on December 22, 1924, adopted a bill forcing employers to provide adequate sleeping quarters for agricultural laborers. The Senate, however, delayed its ratification interminably.

The country districts suffered also in comparison with urban centers with regard to electrification and even ordinary means of communication. Although the State had undertaken to assist financially in the task of electrification, by 1927 electric current was available for domestic and agricultural purposes in fewer than 17,000 of the 37,800 communes in continental France.[60] Moreover, 13,348 communes were still without telegraphic facilities and 11,829 communes without telephones.[61] The rural parcel-post system too was inadequately developed, the service being performed by railway companies which delivered only to the nearest station where the farmer was obliged to go for his package. Communications were further hampered by the poorness of the outlying roads.

A reform which might have increased somewhat the productive output of the French soil was the abolition of the system of landholding in strips. In the east and northeast of France, there were still in the post-war period peasant holdings made up of small strips of land scattered over the countryside lying within the vicinity of a village. This vestige of medieval days was obviously unsuited to the modern technique of agriculture based on machines, fertilizers and a limited supply of labor. A law was passed on November 27, 1918 (*la loi Chauveau*) relative to a redistribution of such rural property, but legal measures could make little headway against so old a tradition.

Conclusions

The depopulation of the countryside and the fact that there is less land cultivated than formerly do not necessarily constitute a bad augury for the future of French agriculture. It probably means that the poorer marginal lands — indeed a small proportion of the total — are being abandoned in favor of the factory. But the agricultural development of the remaining lands will undoubtedly continue. It is this more fertile soil on which the efforts of mechanizing agriculture are expended. More machines and a greater variety of them are being constantly introduced. Coal, oil and electricity are no longer the exclusive appanages of industry, for they are being used to an ever increasing extent on the farm. The shortage of labor may in the long run prove to be more of a boon than a check to agricultural progress, for it accentuates the mechanization of the tillage of the soil. Agriculture tends to adopt industrial methods in its business organization also, for farmers, as has been observed, organize more and more in order to increase credit facilities and to obtain a better control of the market. A possible obstacle in the way of industrialization in French agriculture is the constant increase in the number of small farms.

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[60] Maurice Bitouzet, "L'Électricité en Agriculture," in Augé-Laribé *et alii*, *Agriculture*, Les Cahiers du Redressement Français, No. 5, p. 102.

[61] *Idem*, p. 18.

Another reason for predicting further agricultural progress in France lies in the fact that France is somewhat behind her neighbors and that there is a visible gap to fill. Various groups, public and private, are taking vigorous measures to bring French agriculture up to the international standard. For one thing, the yield per acre needs to be increased. There is, however, no magic short cut to progress. Future development will mean the untiring pursuance of a varied program in regard to education, machinery, fertilizers, coöperation, credits and marketing.

It is very probable that even under the most favorable circumstances the increase in agricultural productivity will necessarily be of modest proportions. It is not in the nature of agriculture to undergo a rapid transformation like industry. All over the world, in fact, the development of factory production in recent times has far outdistanced that of agriculture. The new resources and new equipment that France acquired after the war on contiguous territory were industrial and not agricultural. The postwar colonial expansion of France only served to accentuate the dependence of the mother country on soils beyond the seas for raw agricultural materials and foodstuffs. The overabundance of industrial products has forced France to seek foreign outlets, and at the same time to balance these sales by purchases abroad of manufactured goods, raw materials and foodstuffs as well. The race for agricultural self-sufficiency seems to be a losing one.

CHAPTER XVII

FOREIGN TRADE

1. The Pre-War Foreign Trade of France

In 1913 France's part in the world's international commerce bulked relatively large, amounting to 7.82 per cent of the total. In this respect she was then surpassed only by three nations: Great Britain, with 15.28 per cent; Germany, with 13.15 per cent; and the United States, with 11.18 per cent. Holland followed closely on France with 7.42 per cent, and then came Belgium with 4.23 per cent.[1] Yet France was not, like these latter countries, essentially a foreign trading nation; for with her comparatively wider territory, her very abundant agricultural resources, her important mineral reserves and her fairly advanced industrial equipment, her mass of domestic exchanges must certainly have outweighed many times her volume of exports and imports.

The point reached by France on the eve of the war in foreign commerce was the consequence of many years of constantly accelerated growth. While from 1875 to 1900 the total value of French foreign trade rose about 20 per cent, from 1900 to 1913 it increased nearly 75 per cent.[2] During this whole period of nearly four decades there were no territorial changes in France, but on the other hand her industry was being steadily developed. The expanding volume of French foreign commerce was the result of her own industrial progress and of the international division of labor which was becoming more and more marked as the nations of Europe and North America were advancing industrially.

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[1] Société des Nations, *Memorandum sur les Balances des Paiements et sur les Balances du Commerce extérieur, 1910–1924*, Vol. I, p. 98. These percentages are ratios of the total foreign trade of 49 countries whose exports and imports represented about 93 per cent of the whole international commerce of the world. The figures refer to commodity trade only, exclusive of bullion and specie.

[2] *Annuaire Statistique, 1926*, p. 95.

One of the noteworthy characteristics of French pre-war foreign trade was the persistence of an adverse balance, that is, of an excess in the value of imports over that of exports. If trade in bullion and specie be added to that in commodities, the annual statistics of every year from 1875 to 1913 reveal a greater expenditure on imports than income from exports.[3] The adverse balance in commodity and specie accounts was, however, almost always more than compensated by the payment of interest on French investments abroad, by the expenditure of tourists in France, by the net earnings of French shippers carrying foreign tonnage, and by other transfers of funds from the outside for services rendered. The result was that, in spite of her unfavorable trade balance, France had notoriously large funds to invest abroad, which increased from 10 or 12 billion francs in 1875 and to some 40 billion in 1913.[4]

By far the most important French imports before the war consisted of raw materials, such as wool, cotton and silk for her textile mills, and coal and a considerable amount of heavy machinery for her general industrial plant equipment. France imported foodstuffs, too, principally cereals, oleaginous seeds, some wine and fruit as well as tropical and semi-tropical products like coffee, tea and tobacco. Pre-war French exports were composed mainly of manufactured products such as textile fabrics, clothing and lingerie. A great quantity of vehicles (chiefly automobiles), chemicals, prepared hides, wines and mechanical engineering products were also sold abroad. The following table (see next page) gives the leading imports and exports in 1913 arranged in order of their importance.

It will be observed in this table that there was a great variety of commodities in both exports and imports. The largest single import item in 1913, in point of value, was raw wool, but that made up only 8 per cent of the value of all imports. Likewise silk fabric, which made up the largest single export item in point of value, constituted less than 6 per cent of the value of all exports in 1913. Another significant feature of the foreign trade of France before the war was the fact that the various items when grouped

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[3] Harold G. Moulton and Cleona Lewis, *The French Debt Problem*, pp. 14–16.

[4] *Ibid.*, p. 329.

PRINCIPAL IMPORTS AND EXPORTS IN 1913

Imports		Exports	
Commodity	*Value (In millions of francs)*	*Commodity*	*Value (In millions of francs)*
Raw Wool	702	Silk Fabric	386
Coal and Coke	584	Cotton Fabric	385
Raw Cotton	577	Raw Wool	310
Cereals	566	Clothing	253
Oleaginous Seeds and Fruit	388	Vehicles	245
Raw Silk	361	Woolen Fabric	220
Machines, Boilers and Spare Parts	321	Chemical Products	211
Wines	275	Wines	203
Raw Hides	249	Raw Hides	180
Lumber	236	Raw Silk	179
Coffee	208	Prepared Hides	145
Copper	193	Tools and Metal Structures	137
Chemical Products	157	Machines, Boilers and Spare Parts	123
Mineral Oil	139		
Rubber	123		

in larger categories showed an unfavorable balance for foodstuffs (−979 million francs in 1913) and for industrial materials (−3,088 million francs in 1913), but a favorable balance for manufactured goods (+2,525 million francs in 1913). A considerable portion of French pre-war foreign trade was in partly manufactured commodities, and this was quite typical of the international commerce of most manufacturing nations.

Most of the French trade was carried on with neighboring countries. Even though modern methods of transport had enormously facilitated the movement of raw materials from distant parts and the shipping of manufactured goods to far-off markets, the greatest interchange of commodities took place not over lengthy trade routes but with countries close at hand. Thus Great Britain was France's best customer in 1913, purchasing 21.1 per cent of French exports in that year. Belgium came second, purchasing 16.1 per cent, Germany next with 12.6 per cent, and then Algeria (about 8 per cent), the United States (6.1 per cent), Switzerland (5.9 per cent), Italy (4.4 per cent) and Spain (2.2 per cent).[5]

Great Britain was not only the biggest single buyer of French goods, but she was also the most important source of French imports, having sold to France in 1913 13.2 per cent of all the goods imported into the latter country. France imported very largely also from Germany (12.7 per cent in 1913) and from the United States (10.6 per cent in 1913). Among the other countries from which France purchased appreciable quantities of goods in 1913 were Belgium (6.6 per cent), Russia (5.4 per cent), India (4.6 per cent), Algeria (between 4 and 5 per cent), Argentina (4.4 per cent), Australia (3.4 per cent), Spain (3.3 per cent), Italy (2.9 per cent), Brazil (2.1 per cent) and Switzerland (1.6 per cent).[6] The large part played by Algeria, Australia, South America and the Far Eastern countries was due to the fact that these were the main sources of raw wool or silk.

2. The Effects of the War on French Foreign Trade

The foreign trade of France was thoroughly disorganized by the war. All commerce with enemy countries was completely cut off, while trade with other nations was badly handicapped. During hostilities all exports and imports were put under very strict state supervision. The decreased productivity of France resulted in a greatly increased excess of imports over exports, the bulk of the additional imports coming mainly from the United States and other American countries.

Immediately on the restoration of peace French foreign trade was found to be in a chaotic and disastrous situation. With a large part of her productive equipment and resources badly damaged, France was more dependent than ever on imports. This was especially true of coal. Moreover, because her railway system was partly wrecked and for the most part in a state of confusion, rapid recovery of industrial and commercial activity was rendered all the more difficult. Another result of the war was the disordered currency and the consequent fluctuations in prices which generally discouraged purchases and sales abroad. There were, in addition, new tariff barriers to be faced, not always higher than in pre-war years but constantly changing and uncertain. Where there had been 20 nations in Europe, each an independent economic entity with more or less high tariff walls, there were in 1919 29 such nations. The situation was aggravated by the fact that the new eastern and central European nations were endeavoring to set themselves up as self-sufficient industrial units by cutting off imports through high protective tariffs.

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[5] Société des Nations, *op. cit.*, p. 175.

[6] *Idem*, p. 155.

In the years immediately following the war, therefore, the foreign trade of France, as of most European countries, fell far below the pre-war norm. In 1919 her exports in weight were only 25 per cent of those of 1913. They were indeed more compressed in France than in any other European country except Russia and perhaps Germany, as is seen in the following table:

Country	*Ratio of weight of exports in 1919 to weight of exports in 1913* [7]
Switzerland	111%
Sweden	55
Great Britain	50
Spain	40
Belgium	33
France	25
Germany	27 (1920)
Russia	(less than .1%)

French imports also were smaller than they had been in 1913, but they had not fallen as much as exports, owing to the urgent need for goods and to credit facilities granted abroad. In 1919 the weight of commodities entering France was 87 per cent of what it had been in 1913. The table below shows France at the top of the list of the principal European countries with regard to the relative volume of imports in 1919 as compared with that of 1913:

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[7] Computed from statistics given in Société des Nations, *op. cit.*, pp. 135–136. The figures refer to trade in commodities only, exclusive of bullion and specie.

Country	*Ratio of weight of imports in 1919 to weight of imports in 1913* [8]
France	87%
Great Britain	71
Sweden	53
Switzerland	52
Spain	38
Germany	26
Belgium	15 (1920)
Russia	(less than .1%)

The unusually high level of imports in France in 1919 was due largely to the great bulk of coal that had to be imported at that time. In the main, French imports were somewhat more seriously affected than is shown in the table, for when coal is left out of account, the ratio of 1919 imports in weight to those of 1913 is 80 instead of 87 per cent.

The Growth of the Post-War Foreign Trade of France

The development of French foreign trade in the post-war years was rapid and almost continuous. By 1927 French exports attained the value of 55.2 billion francs, whereas they had only been worth 6.9 billion in 1913. This does not imply anything like a seven or eight-fold growth, for in the interval the franc fell to about one-sixth of its 1913 wholesale purchasing power.[9] Nevertheless even in terms of francs of a constant purchasing power there was an appreciable increase in the value of exports. When measured in weight instead of value, the expansion in exports was even more marked, for they rose from 22 million tons in 1913 to 38 million in 1927.

These comparisons are, in a sense, misleading, for France changed her frontiers twice after 1913, once at the close of 1918 with the reannexation of Alsace-Lorraine[10] and again on January 10,

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[8] *Idem.*

[9] The average of the monthly wholesale index price numbers for 1927 on a 1913 base was 617 (Statistique Générale de la France). See above, Chapter III, page 50, note 2.

[10] Treaty of Versailles, article 51.

1925, with the incorporation of the Saar region within the customs area of the country.[11] If, therefore, the late post-war export figures be corrected to omit the Saar,[12] then it is found that from 1913 to 1927 there was a rise of 66 per cent in weight, and a smaller rise of 27 per cent in value in terms of francs of constant (1913) purchasing power. It is, however, impossible to make even very rough corrections for Alsace-Lorraine. There is consequently no way of telling how much of the 1913–1927 expansion in exports was due simply to the reincorporation of Alsace-Lorraine. It is even conceivable that the French exports of 1927 may not quite have equalled the combined exports of France and Alsace-Lorraine in 1913, for after the war the latter region ceased to ship as much iron and steel and textiles into Germany as it had done when it was part of Germany.

Whatever may have been the rôle of Alsace-Lorraine in the post-war foreign trade of France, there was, as is seen in the following table, a rapid and almost uninterrupted development of exports when measured in terms of weight:

Year	*Exports* (*In millions of tons*)
1913 (not including Alsace-Lorraine	22.1
1919 (including Alsace-Lorraine)	5.6
1920 " " "	12.9
1921 " " "	16.0
1922 " " "	22.6
1923 " " "	24.9
1924 " " "	29.4
1925 " " "	28.8 (Saar excluded)
1926 " " "	30.9 (Saar excluded)
1927 " " "	36.6 (Saar excluded)

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[11] *Ibid.*, article 50, Annex, Chapter II, § 31.

[12] It is possible to make an approximate correction for the Saar territory, so as to render the 1925, 1926 and 1927 foreign trade statistics of France more comparable with those of the preceding years. If it be assumed that the exports and imports of the Saar in 1924 subsisted in about the same proportions during the following three years, then in order to eliminate the Saar from the French customs figures of 1925, 1926 and 1927, 2 per cent should be subtracted from the reported exports in value, .6 per cent added to the reported imports in value, 1.5 million tons subtracted from the total exports in weight and 2.5 million tons added to total imports in weight.

It will be noticed that during the first three years after the war the weight of exports of France and Alsace-Lorraine was below that of France alone in 1913. The same phenomenon is observable when exports are measured in terms of value:

Year	*Exports* (*In billion francs of 1913 purchasing power*) [13]
1913 (not including Alsace-Lorraine)	6.9
1919 (including Alsace-Lorraine)	3.3
1920 " " "	5.3
1921 " " "	5.7
1922 " " "	6.5
1923 " " "	7.3
1924 " " "	8.5
1925 " " "	8.2 (Saar excluded)
1926 " " "	8.3 (Saar excluded)
1927 " " "	8.8 (Saar excluded)

France was unquestionably selling more goods abroad in the latter post-war years than in 1913, but it is not known whether she sold more than France and Alsace-Lorraine combined on the eve of the war.

The post-war increase in imports was neither so marked nor so regular. The value of French purchases abroad, in 1927, measured in terms of francs of a constant (1913) purchasing power, amounted to 8.6 billion francs [14] as compared with 8.4 billion in 1913. In weight the growth was somewhat more important, from 44.2 million tons in 1913 to 51.9 million in 1927.[15] For only two of the post-war years were the imports in weight of greater France below the pre-war imports of France without Alsace-Lorraine — in 1919 and in 1921, as is seen in the following table:

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[13] Computed on the basis of the annual averages of monthly wholesale price index numbers (*S. G. F.*).

[14] Corrections made to exclude the Saar, see above, p. 525, note 12.

[15] Corrections made to exclude the Saar.

Year	*Imports* (*In millions of tons*)
1913 (not including Alsace-Lorraine)	44.2
1919 (including Alsace-Lorraine)	38.4
1920 " " "	50.5
1921 " " "	40.1
1922 " " "	51.4
1923 " " "	54.9
1924 " " "	56.6
1925 " " "	49.9 (Saar excluded)
1926 " " "	48.0 (Saar excluded)
1927 " " "	51.9 (Saar excluded)

The high level reached by imports as early as 1920 is to be accounted for chiefly by the fact that enormous purchases of heavy material had to be made abroad at that time for the industrial reconstruction of the north. The sharp decline in 1921 was a temporary phenomenon, due to the world business crisis of that year. If imports are calculated in terms of a stable standard of value, the results are somewhat different, the peak year being 1919 instead of 1924, as is seen in the following table:

Year	*Imports* (*In billions of francs of 1913 purchasing power*)[16]
1913 (not including Alsace-Lorraine	8.4
1919 (including Alsace-Lorraine)	10.1
1920 " " "	9.8
1921 " " "	6.4
1922 " " "	7.3
1923 " " "	7.8
1924 " " "	8.2
1925 " " "	8.1 (Saar excluded)
1926 " " "	8.5 (Saar excluded)
1927 " " "	8.6 (Saar excluded)

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[16] Computed on the basis of the annual averages of monthly wholesale price index number (*S. G. F.*).

France compares very favorably with other European countries in the post-war recovery and development of foreign trade. In 1913 her share of the total European international commerce was 13.4 per cent, and in 1924 it rose to 15.4 per cent.[17] The gain was made through the rise in exports, for the proportion of French imports to those of all Europe fell from 13.6 per cent in 1913 to 13.4 per cent in 1924, while the proportion of exports rose from 13.1 per cent in 1913 to 17.8 per cent in 1924.[18] Moreover, the value of the foreign trade of France, measured in terms of a constant (1913) purchasing-power currency, rose 9 per cent from 1913 to 1924, while that of Great Britain measured in the same way declined 3 per cent, that of Switzerland declined 13 per cent, and that of Germany declined 42 per cent.[19] The fact that France

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[17] Société des Nations, *op. cit.*, p. 98. The percentages were computed on the basis of recorded values of foreign trade of European countries, reduced to dollars. The choice of 1924 rather than any of the later post-war years as a point of comparison with 1913 was determined by the fact that 1924 was the last year in which the Saar's foreign trade was not included with that of France. For detailed analysis it was found impossible to make corrections excluding the Saar in 1925, 1926 and 1927.

[18] League of Nations, *Memorandum on the Balance of Payments and Foreign Trade Balances, 1911–1925*, p. 132. The percentages were computed on the basis of the recorded values (reduced to dollars) of exports and imports of all European countries except Holland. The ratio of the foreign trade of some of the principal countries of Europe to the foreign trade of the whole continent is shown in the following table. No allowances were made for territorial changes in the interval.

PERCENTAGE OF FOREIGN TRADE OF ALL EUROPE

(26 nations in 1924)

Country	Imports		Exports		Total	
	1913	1924	1913	1924	1913	1924
Great Britain	26.8	32.1	25.3	29.1	26.1	30.1
Germany	21.4	13.9	23.7	12.8	22.5	17.0
France	13.6	13.4	13.1	17.8	13.4	15.4
Italy	5.9	5.4	4.8	5.1	5.4	5.3
Belgium	7.3	5.2	6.9	5.3	7.2	5.3
Spain	2.1	3.6	2.0	2.9	2.1	3.3
Russia	5.8	1.4	7.7	2.2	6.7	1.8

[19] League of Nations, *Memorandum on Balance of Payments and Foreign Trade Balances, 1911–1925*, pp. 182–195.

was alone among these European nations to have acquired appreciable contiguous territory through the reannexation of Alsace-Lorraine may explain why her foreign trade appeared to have made more progress than that of her neighbors.

In contrasting the volume of foreign commerce of France in post-war and in pre-war years, it must not be assumed that there was anything like a stationary trade situation before the war. Quite on the contrary, during the decade from 1904 to 1913, the value of France's imports and exports combined had increased over 70 per cent. Had there been no war, and had this general development continued uninterrupted, French foreign trade in 1927 would have been about 100 per cent greater than in 1913, instead of 9 per cent greater as it actually was, when measured in terms of 1913 francs.

Changes in the Composition of French Foreign Trade

The exports of France after the war differed very considerably from those of pre-war France in the nature of the constituent commodities. There was a decided tendency, for example, to sell abroad more manufactured goods, and, at the same time, less foodstuffs and industrial materials. This is seen in the following table:

Composition of French Exports[20]
(*In value*)

Category	*Percentage of Total*	
	1913	*1924*
Foodstuffs	13	10
Industrial Materials	27	25
Manufactured Goods	60	65

In fact, while the weight of manufactured goods exported rose 58 per cent from 1913 to 1924 and that of industrial materials rose 32 per cent, the weight of foodstuffs increased only by 12 per cent.

There was a contrary change in the nature of commodities imported in the direction of a lesser emphasis on manufactured goods.

[20] See *Annuaire Statistique, 1926*, p. 95, for figures up to 1925, and *Stat. Mens. Com. Ext.* for 1925–1927 figures. For the choice of the year 1924 as a basis of post-war comparisons, see above, p. 528, note 17.

Category	*Composition of French imports*[21] *(In value)*	
	1913	*1924*
Foodstuffs	21%	22%
Industrial Materials	59	65
Manufactured Goods	20	13

The weight of manufactured goods imported even declined from 1913 to 1924 by 5 per cent, while the weight of foodstuffs and industrial materials rose respectively 3 and 33 per cent.

The significance of these changes can be appreciated somewhat more concretely in an examination of some of the particular items whose exports and imports increased notably after the war as compared with the pre-war years. Thus, for example, among the exports which had expanded most were such manufactured articles as rubber goods, iron and steel mechanical engineering products, chemicals, soaps and perfumes, and silk fabrics.

Article	*Ratio of weight of exports in 1924 to weight of exports in 1913*
Rubber Goods	398%
Iron and Steel	307
Automobiles	240
Machinery	201
Chemical Products	190
Soap and Perfumes	148
Silk Fabric	139

Among the imports which showed the greatest increase were fresh and frozen meat, sugar, petroleum, raw rubber, coffee, fish, coal and fruit — that is to say, foodstuffs and industrial materials.

It is difficult to determine what the causal factors were that entered into these fundamental modifications in the composition of exports and imports. It is obvious that they reflect the progress in industrialization of post-war France, since foreign markets for French manufactures expanded, French imports of foreign manufactures declined, and the volume of materials for industry entering France increased. The stimulating influence of monetary

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[21] *Ibid.*

Article	*Ratio of weight of imports in 1924 to weight of imports in 1913*
Meat (fresh and frozen)	429%
Sugar	410
Pearls	350
Petroleum	279
Raw Rubber	236
Coffee	148
Fish	147
Coal	138
Fruit	130

inflation on industrial activity may have been partly responsible for the initiation of these changes, but it should be noted that the trend continued even after inflation ceased, for in 1927 the weight of French manufactured exports (including those of the Saar) reached its peak, being nearly 50 per cent greater than in 1924 and 13 per cent greater than in 1926, while the weight of French manufactured imports in 1927 (including the Saar) declined 22 per cent since 1924 and 16 per cent since 1926. Undoubtedly the reannexation of Alsace-Lorraine and the inclusion of the Saar from 1925 contributed to the change in the nature of French foreign trade.

The Countries with Which France Traded

After the war, Great Britain continued, as in 1913, to be France's most important customer, but in 1925 she bought only 19.7 per cent of the French exports as against 21.1 per cent before the war.[22] In 1925 about two-thirds of the British purchases in France consisted of manufactured goods, 7 per cent were foodstuffs, and 27 per cent industrial materials. The composition of exports to Great Britain was, in general, very much like the composition of the total French exports.[23] Moreover, there was a great variety of items in the movement of goods from France to Great Britain, the principal ones being silk fabric, pearls, clothing, precious stones, metallurgical products, woolen fabrics, automobiles and rubber goods.

[22] League of Nations, *Memorandum on Balance of Payments and Foreign Trade Balances, 1911–1925*, Vol. I, p. 221.

[23] See above, p. 529.

Post-war Belgium, united in a customs union with the Duchy of Luxemburg, also continued to hold the second rank among France's customers. The proportion of all French exports going to these two countries in 1925 was 16.7 per cent as compared with 16.1 per cent going to Belgium alone in 1913. Their purchases in 1925 consisted largely of raw wool, precious stones, iron and steel, machines and tools, automobiles, silk fabric, pearls, leather, furs, woolen yarn, and chemical products. On the whole, French exports to Belgium and Luxemburg were made up mainly of manufactured goods (55 per cent in 1925) and industrial materials (41 per cent), foodstuffs forming an almost negligible part (4 per cent).

Germany, though still, as before the war, the third most important customer of France, bought in 1925 only 8.3 per cent of the total French and Saar exports (and in 1924, 9.3 per cent of total exports from France alone) as compared with 12.6 per cent in 1913. Part of this decline is explained by the fact that post-war Germany was a much smaller country than she had been before the war. On the other hand, since the movement of goods from Alsace-Lorraine to Germany, which had been very considerable before the war, was counted after the war only as part of French exports to Germany, a certain compensating increase might have been expected. It appears, however, that from Alsace-Lorraine as from the rest of France the post-war exports to Germany diminished in comparison with 1913 shipments to the same destination.

Germany, like Belgium, purchased mainly manufactured goods (53 per cent in 1925) and industrial materials (39 per cent), but very few foodstuffs (8 per cent) from France. This is evidence of a close relationship of industrial interdependence between France and her immediate northern and eastern neighbors. Germany bought from France mainly raw wool, machines and tools, metallurgical products, leather, woolen yarn, pearls, chemical products, and in the latter years a certain amount of coal from the Saar.

The United States was the fourth largest buyer of French goods, taking a somewhat larger portion in 1925 (6.7 per cent) than in 1913 (6.1 per cent). Over 75 per cent of the American purchases in France in 1925 consisted of manufactured goods such as silk fabric, clothing and lingerie, cotton and woolen fabrics, tools and optical glass.

Then, in the order of their importance as importers of French goods, came Switzerland, Algeria, Italy, Spain, Holland, Morocco, Argentina, Indo-China, Tunisia, Brazil, Senegal, Canada, Madagascar, Japan, Czechoslovakia, Sweden and Norway. It will be observed that some of the French colonies and protectorates hold a relatively high rank in this list. In fact, the proportion of France's total exports going to her colonies and protectorates amounted in 1925 to 14.2 per cent, as compared with 13 per cent in 1913. This increase was due, in all probability, partly to the aggrandisement of the French colonial domain after the war and partly to Alsace-Lorraine's endeavor to compensate for the loss of the German market by exporting to the colonies. Four-fifths of the goods shipped from France to her colonies, mandates and protectorates in 1925 consisted of manufactured goods, chiefly cotton fabrics, tools and other iron and steel products. Foodstuffs constituted about 14 per cent of these exports, and industrial materials only about 6 per cent, for the colonies are mainly agricultural and very little developed industrially.

Whereas in 1913 France imported more goods from Great Britain than from any other country, in the post-war years it was the United States which became the principal foreign supplier of commodities to France. Of all the French imports in 1925, 14.5 per cent came from the United States, as against 10.6 per cent in 1913.[24] Great Britain's fall from first rank as a source of French imports was not accompanied by any diminution in the percentage of total imports; in fact, the ratio increased slightly from 13.2 per cent in 1913 to 13.4 per cent in 1925. On the other hand, Germany's portion fell very sharply from 12.7 per cent in 1913 to 5.4 in 1925. The territorial changes — such as the transfer of Alsace-Lorraine and the Saar from Germany to France, and the general contraction in the area of Germany — account partly for the relative reduction in French imports from Germany. It may have been due also to delays in reëstablishing normal Franco-German commercial relations.

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[24] League of Nations, *Memorandum on Balance of Payments and Foreign Trade Balances, 1911–1925*, p. 199.

The principal category of imports coming from the United States, Great Britain and Germany consisted of industrial materials. In 1925 these raw and partly manufactured goods necessary for industry constituted 78 per cent of the total from the United States, 73 per cent of the total from Great Britain and 60 per cent of the total from Germany. Manufactured goods made up a fairly large proportion of French imports from Great Britain (25 per cent in 1925) and Germany (35 per cent), but a comparatively small proportion of the imports from the United States (14 per cent). These nations sent but small amounts of foodstuffs into France. The most important items purchased from Great Britain were coal, pearls, wool, precious stones, rubber, machinery, cotton yarn and tin. From Germany they were coal, sulphate of ammonia, machinery, lumber, paper, tools and sugar. The principal imports from the United States were cotton, oil and its derivatives, cereals, copper and machinery.

In the post-war years the customs union of Belgium and Luxemburg supplied a larger proportion of French imports than Germany — 7 per cent in 1925 as compared with 6.6 per cent in 1913 for Belgium alone. The principal articles in the trade between these countries were precious stones, pearls, coal, wool, zinc, chemical products and flax. From Italy, France imported mainly raw silk; from Argentina, raw wool and cereals; from Algeria, wine; from Holland, precious stones; from China, raw silk; from Spain, fruit; from Switzerland, machinery and instruments of precision; from Indo-China, rice and rubber; from Sweden, wood, paper and wood pulp; from Senegal, peanuts and vegetable oils; from Tunisia, wines and cereals; from Japan, raw silk; from Canada, cereals; from Madagascar, leather and rice; from Norway, paper; from Morocco, raw wool; and from Czechoslovakia, glass. The proportion of imports coming from France's colonies, protectorates and mandated territories, taken together, was large, but changed very little from pre-war to post-war years — from 10.2 per cent (average for 1912–1913) to 10.3 per cent (average for 1925–1926).

The war, indeed, did not effect any fundamental transformation in French foreign trade, taken as a whole, over the entire post-war period. There were, to be sure, some very sharp fluctuations from year to year, and trade in certain articles was completely modified, but the only change of any significance was the diminution in the relative proportion of imports coming from Germany after the war. In 1919, instead of forming, as in 1913, 12.7 per cent of the total foreign goods entering France, imports from Germany constituted only 2.1 per cent. The proportion rose in 1920 and 1921 to 5.3 and 11.5 per cent respectively, perhaps because of the currency inflation in Germany which was coincident with deflation in France. It is to be noted, however, that in 1922 when the inflation of the German mark was even more acute, the percentage of French imports coming from Germany fell again to 6 per cent. A low point was reached in 1923, with 3.6 per cent, but that was clearly due to the occupation of the Ruhr. Immediately afterwards the proportion rose fairly steadily: 5.1 per cent in 1924, 5.4 per cent in 1925, 8.3 per cent in 1926 and 8 per cent in 1927, but remained far below the pre-war level. The following table gives the course of French imports from Germany in francs of constant (1913) purchasing power:

Year	*Imports from Germany (In millions of francs of 1913 purchasing power)* [25]
1913	1,069
1919	212
1920	524
1921	757
1922	441
1923	279
1924	420
1925	432
1926	707
1927	683

The ratio of French exports destined for Germany to the total French exports also declined after the war, but much less than in the case of imports:

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[25] *Annuaire Statistique, 1926,* p. 100. The figures for 1926 and 1927 were taken from *Stat. Mens. Com. Ext.* The reduction to francs of 1913 purchasing power was computed on the basis of the annual average of the monthly wholesale price index numbers (*S. G. F.*) on a 1913 base.

Year	Proportion of Total French Exports Going to Germany	Exports to Germany (In million francs of 1913 purchasing power)[26]
1913	12.6%	868
1919	13.1	437
1920	5.6	295
1921	1.5	544
1922	9.2	602
1923	3.5	257
1924	9.3	811
1925	8.3	683
1926	7.5	634
1927	11.7	1,048

It is interesting to observe that in 1921 and in 1922, when the status of the German mark in relation to the French franc was such as to discourage the movement of goods from France to Germany (since the mark was falling and the franc was rising in relation to gold), French exports to Germany were nevertheless maintained at a fairly high level. In 1923 the occupation of the Ruhr proved to be as disastrous to exports to Germany as it was to imports from Germany. With the resumption of more normal relations in 1924, and with the stabilization of the mark in that year, the French sold to Germany almost as much as in 1913. Finally in 1927, when both the franc and the mark ceased to fluctuate, the value of French exports to Germany, in terms of francs of a constant purchasing power, far exceeded that of 1913, and formed almost as large a proportion of the total value of all French exports as before the war.

3. THE PROBLEM OF SELF-SUFFICIENCY AND THE BALANCE OF TRADE

The analysis of French imports indicates clearly that France, both before and after the war, purchased enormous quantities of varied goods from many different parts of the world. She was therefore not self-sufficient. Nor does it appear at all possible that she may in the future become independent of imports and at the same time maintain her standards of industrial activity and material comfort. She could indeed ill dispense with English and German coal, or American copper or Chilean nitrates — at least under current conditions. Her great textile manufactures all depend almost completely on imported raw materials. Nearly all the mineral oil, a very large part of the metallurgical coke, much of the raw hide, a great deal of wood pulp and lumber, and all the raw rubber needed in France come from abroad. These are materials necessary for industry. Among the consumers' goods for which there are few or no sources of supply in France are coffee, tobacco, tea, and tropical fruit. Even cereals and wines, which form the basis of the French diet, are in part imported. It must be added also that France's lucrative trade in precious stones and pearls, while not indispensable, contributes to the national social income and enriches the business life of the community. To argue therefore that because France has a varied climate and abundant natural resources of her own, and could, at a pinch, perhaps feed herself, provided there were a reduced social income, a decreased industrial activity, and an entirely modified economic organization, is quite irrelevant. Under the stress of eventual war conditions, with much of her man power taken from the fields and factories, the possibility of arriving at a self-sufficient status seems even further removed.

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[26] *Idem.*

A more practical concept of self-sufficiency does not exclude imports but is based on a balanced relationship of exports and imports. It has already been noted that during several decades before the war the balance of French trade was almost uniformly unfavorable, and that it required the income from foreign tourists in France, the interest on French investments abroad, etc., to make up for the disbursements on the excess of imports. During hostilities, when France was obliged to purchase abroad war supplies and other goods in unprecedented quantities and when her export capacity was very much reduced, then her only way of covering her unfavorable balance was by selling out her foreign securities and by raising foreign credits wherever possible, for income from tourists, shipping services and commissions practically ceased. Once hostilities were over, a hard climb was begun toward a favorable trade balance which was not attained until 1924, as is seen in the following table:

Year	Balance of Trade, Merchandise Only [27] (In millions of current francs)	Ratio of Value of Exports to Value of Imports; Merchandise Only
1913 (not including Alsace-Lorraine)	−1,541 [a]	82%
1919 (including Alsace-Lorraine)	−23,919	33
1920 “ “ “	−23,010	54
1921 “ “ “	−2,295	87
1922 “ “ “	−2,551	88
1923 “ “ “	−2,246	94
1924 “ “ “	−1,540	104
1925 “ “ “	+500 [b]	101 [b]
1926 “ “ “	−1,450 [b]	98 [b]
1927 “ “ “	+1,000 [b]	102 [b]

[a] Minus = excess of imports; + = excess of exports.

[b] Saar excluded, see above, p. 525, note 12.

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[27] Excluding trade in bullion and specie, which was generally not as large after the war as before.

FRENCH FOREIGN TRADE IN BULLION AND SPECIE

(In millions of francs)

Year	Imports	Exports
1910	406	390
1911	462	285
1912	531	325
1913	975	431
1919	176	37
1920	215	688
1921	662	874
1922	125	77
1923	66	83
1924	116	240
1925	150	135
1926	215	170
1927	77	663

It will be observed that immediately after the war the balance of trade was extremely unfavorable. It was necessary to import enormous quantities of merchandise not only to meet the needs of the community and to cover the deficiencies in national production, but also to reconstruct the damaged and destroyed industrial equipment in the north. Moreover some time elapsed before French industry was in a position to produce large surpluses for export. By 1921, however, the pre-war ratio of exports to imports was restored; and after that there was a continuous improvement in the balance of trade until 1924 when the value of exports exceeded that of imports by about 4 per cent. Nor does this appear to have been a sporadic event, as was the favorable balance of trade in 1905 (the only year from 1876 to 1913), for during the four years from 1924 to 1927 exports continued, on the average, to exceed imports, if only slightly.

The post-war movement in the French balance of trade was closely bound up with the fluctuations in the balance of general international transactions, of which trade in merchandise was simply a part. For example, if France was able to procure abroad in the years immediately after the war the vast quantities of goods she needed, it was thanks to the credits she was still able to raise, as in wartime, in order to cover the excess of imports. These commercial borrowings and the German reparation deliveries were both important factors in the early rehabilitation of production and trade in post-war France. Moreover the relatively slower growth of imports as compared with the rise in exports during the post-war years was probably connected with the loss, during the war, of French foreign investments, since much of the interest reached France before the war ultimately in the form of merchandise. Instead of having 45 billion gold francs invested abroad yielding some 1.7 to 2.0 billions in interest as before 1914, France had in 1926 perhaps 11 or 12 billion gold francs of foreign investments (not counting the exportation of capital after 1924 under the stress of inflation), and the annual yield probably amounted to no more than 500 or 600 million gold francs.[28] Obviously, with the general rise in international gold prices, the volume of goods which entered France representing interest payments must have fallen to less than a quarter of what it had been before the war.

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[28] P. Meynial, "La Balance des Comptes," *Revue d'Économie Politique*, March–April 1927, pp. 287–289.

The effects of the changes in other items of the general balance of international transactions are difficult to trace, because of the chaotic movement of funds, now out of France in the flight before the depreciation of the franc, and now back to France again as soon as revalorization and stabilization set in. The continual wide fluctuations in the value of the franc from the close of the war to the end of 1926 make any accurate measurements of the balance of accounts impossible. There can be no doubt, however, that the decrease in the interest on French investments abroad, the expenditures of foreign tourists in France, and the massive movements of capital back and forth across the frontiers contributed to render the balance of French foreign trade in the post-war years more favorable than it had ever been before.

It is hard to say whether the better balanced relationship between French exports and imports in the latter post-war years was a more or less permanently established industrial and commercial phenomenon of the country, or whether it was simply a post-war accident related to other accidents in the general balance of accounts. Moreover, the reputed tendency of inflation to stimulate exports and inhibit imports would add to the impression that post-war France was becoming commercially self-sufficient in appearance only. It has been seen, however, in a previous chapter [29] that there was, in reality, no clear cut correlation between the depreciation of the franc and the movement of exports and imports because so many other factors, such as the activity of the domestic market, the rate of expansion of production, the reannexation of Alsace-Lorraine, the fluctuations in prices in other countries, etc., intervened also to determine the volume of trade. The inflation of the franc certainly held a very high place among other important influences affecting the movement of exports and imports. That it was not all-important is clear from two facts: first, that manufactured exports did not expand as might have been expected during the most critical months of inflation in 1925 and 1926,[30] and secondly, that in 1927 when the inflation movement ceased, the balance of trade was more favorable than in the two preceding years. It seems, therefore, that the post-war progress achieved by France in the direction of greater commercial self-sufficiency is a function of well rooted industrial resources rather than of ephemeral monetary movements.

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[29] See Chap. VI.

[30] See pp. 139–142.

French Commercial Policy

The French customs tariff in existence on the eve of the war had been enacted by the law of January 11, 1892. This legislation definitely consolidated the protectionist reaction against the free trade doctrines which had exercised a prevalent influence over French commercial policies since 1860. The two outstanding features of the law of 1892 were the imposition of duties on agricultural products hitherto unprotected and the establishment of minimum tariff rates which could not be reduced by international commercial treaties or by the effects of "most favored nation" clauses. Side by side with the Minimum Tariff schedule was the General Tariff schedule applicable to countries having no commercial treaty with France. Another interesting characteristic of the law of 1892 was the exemption from duty which raw industrial materials enjoyed, while manufactured goods and farm products were moderately protected according to the Minimum Tariff schedule.

A law, passed on March 29, 1910, partially modified the law of 1892, but did not change any of its essential principles. The revision was limited to an increase in a certain number of rates. In addition, the new law raised the General Tariff schedule to the extent of establishing a difference of 50 per cent between it and the Minimum Tariff schedule. This latter increase was not of very great importance, since by the time the war broke out France had signed 62 commercial treaties with foreign nations, 35 of which, principally European nations, were given the benefit of the whole Minimum Tariff schedule.[31]

According to the estimate of the League of Nations, the average rate of import duties imposed by France in 1913 amounted to about

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[31] C.-J. Gignoux, *L'Après-Guerre et la Politique commerciale*, p. 16.

18 per cent.[32] This, as is seen in the following table of international comparisons, was relatively high, for the French tariff level was exceeded only by that of the United States, Spain and Argentina:

Country	*Tariff level indices in 1913*[33]
United States	33
Spain	33
Argentina	26
France	18
Austria-Hungary	18
Canada	18
Italy	17
Sweden	16
Germany	12
Denmark	9
Switzerland	7
Netherlands	3

Immediately after the war, and in fact through the whole post-war period under survey (1919–1927), the legislation governing the French tariff system was still substantially that of 1892 as modified in 1910. Nevertheless certain measures had to be taken in order to maintain the effectiveness of these laws in the face of the monetary depreciation at home and of the dumping due to even greater monetary depreciation in other countries. As the franc declined in purchasing power, the French duties, which were for the most part specific and not *ad valorem*, tended to lose entirely their efficacy as trade barriers. A system of coefficients was, therefore, resorted to from 1919 on for the purpose of preserving the same relationship as before the war between the import duties and the value of the articles imported. Since the prices of different articles varied in different proportions, no general coefficient was applicable, and accordingly a lengthy complicated series of coefficients was established affecting no less than 3,294 items from 1919 to 1922.[34] Furthermore, by a decree of March 28, 1921, the General Tariff schedule was raised 400 per cent,[35] and this was chiefly directed against the "exchange" dumping policy of the ex-enemy countries to which the General Tariff applied and whose currency was especially depreciated.

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[32] League of Nations, *Tariff Level Indices*, p. 15, Method B. 1. This percentage was not computed by dividing the total value of imports by the total yield of tariff duties, because the result would give a very incorrect notion of the level of protection afforded. If the duties were all prohibitive so that only goods free of duty were imported, then a percentage determined by such a procedure would be zero, while at the same time the protection would be complete. The above percentage was computed, therefore, on the basis of the average of the percentages which the duties imposed by France are of the values of the commodities which enter into general international trade, and not simply of the commodities which get into France in spite of the tariff. As it was impossible to include all commodities in this computation, 278 sample articles were chosen, and from the statistics of prices of these articles and of the duties imposed on them, percentages representing average tariff levels were calculated. In view of the large margin of error that is inherent in such computations, the results cannot pretend to any precision, but are accurate enough for rough international comparisons and for measuring the movement from year to year. The method is described more fully in the above mentioned League of Nations document.

[33] *Ibid.*

In spite of the numerous post-war revisions and adjustments of tariff rates by partial coefficients and by wholesale increases, the tariff level of France in 1925 fell short of that of 1913 by about 30 per cent. According to the League of Nations estimates, the average tariff impositions of France declined from 18 per cent in 1913 to 12 per cent in 1925, but it should be noted that, in so far as these duties affected manufactured goods only, they rose slightly: from 20 per cent in 1913 to 21 per cent in 1925.[36] Indeed in the latter post-war years the French tariff level was no longer among the highest in the world, as is seen in the following table of international comparisons:

Country	*Tariff level indices in 1925*[37]	*Percentage change from 1913 to 1925*
Spain	44	+30
United States	29	−10
Argentina	26	0
Australia	25	+45
Poland	23	—
Hungary	23	+30
Yugoslavia	23	—

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[34] C.-J. Gignoux, *op. cit.*, p. 34.

[35] *Ibid.*, p. 38.

[36] See Chap. VI.

[37] See footnote 37 on next page.

Country	*Tariff level indices in 1925*[37]	*Percentage change from 1913 to 1925*
Czechoslovakia	19	+5
Italy	17	0
Canada	16	−15
Sweden	13	−20
France	12	−30
Germany	12 [a]	(?) [a]
Austria	12	+45
Switzerland	11	+70
Belgium	8	+35
Denmark	6	−30
United Kingdom	4	—
Netherlands	4	+30

[a] The German index for 1925 is an average of the duties up to October of that year, when there was a revision upwards, and the later duties. The increase from 1913 to 1925 amounted to about 25 per cent.

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[37] League of Nations, *op. cit.*, p. 15. The tariff level indices for manufactured articles only were the following:

Country	*Tariff level indices for manufactured articles*	
	1913	*1925*
Argentina	28	29
Australia	16	27
Austria	18	16
Belgium	9	15
Canada	26	23
Czechoslovakia	18	27
Denmark	14	10
France	20	21
Germany	13	20
Hungary	18	27
India	4	16
Italy	18	22
Netherlands	4	6
Poland	..	32
Spain	41	41
Sweden	20	16
Switzerland	9	14
United Kingdom	..	5
United States	44	37
Yugoslavia	..	23

It will be observed in the above table that France in 1925, instead of having the fourth highest tariff barrier as in 1913, was twelfth in rank. This was due largely to the increase in tariffs of other countries, while those of France fell, not as the consequence of any deliberate policy of revision downwards, but because the administrative and legislative measures increasing the rates could not keep pace with the fall of the franc. In 1926 general augmentations were resorted to, first on April 6 and again on August 14, raising the tariff level in each case by 30 per cent, in an effort to counteract the nullifying influence of the severe monetary depreciation of the time.[38] In addition, certain agricultural duties which had been suspended were reinforced. On the other hand, the commercial conventions concluded by France in 1926 tended to lower the average duties applied. Under such circumstances it is impossible to estimate the exact amount by which the French tariff level was raised, but it was certainly higher in 1926, in spite of the fall of the franc, than it had been in 1925.[39]

A mere survey of French tariff legislation gives an inadequate notion of the commercial policy of post-war France and of the tariff rates actually applied. Before the war, as it has already been observed, the commercial conventions concluded between France and other countries were so numerous that the Minimum Tariff schedule prevailed, while the General Tariff schedule was rather the exception. After the war, the influence of treaty arrangements was no less important, but their character was considerably modified.

Even before the close of hostilities, the French industrial and commercial interests objected to the wholesale concessions of the minimum tariff and the generalization of the "most-favored-nation" clauses which had been characteristic of French pre-war commercial policy. It was pointed out that in return for Minimum Tariff advantages, France often received illusory compensation, because she imported principally raw materials which were practically exempt of duty anyway, while she exported manufactured articles

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[38] C.-J. Gignoux, "La Politique douanière et les Traités de Commerce," *Revue d'Économie Politique*, March–April 1927, pp. 530–531.

[39] League of Nations, *op. cit.*, p. 16.

de luxe which were often highly taxed even on a minimum basis by other importing countries. In order to remedy this situation the French Government on April 23, 1918, denounced all its commercial treaties with European nations, but maintained their terms in force pending the conclusion of new treaties. Then a law was passed on July 29, 1919, authorizing the Government to negotiate commercial treaties on the basis of tariff rates intermediary between the Minimum Tariff and the General Tariff schedules, provided that proportional counter-advantages were granted to France.[40]

The negotiation of the various post-war commercial treaties and temporary accords with foreign powers, on the basis of the law of July 29, 1919, proved to be an extremely delicate matter, for each new convention, which had to be ratified by the Senate and the Chamber of Deputies, established a separate and distinct schedule of tariffs. Among the obvious results of the new policy were the disappearance of any uniform tariff principle and the suppression of the most-favored-nation clause, at least in its old, general and unconditional form. By the opening of 1927 France had concluded eighteen treaties or temporary arrangements with the following foreign powers: Czechoslovakia, Canada, Norway, Finland, Portugal, Spain, Esthonia, Poland, Italy, Belgium, Austria, Turkey, Latvia, Bulgaria, Greece, Haiti, Hungary and Guatemala.

The whole course of French commercial policy in the post-war years, both in its legislative and its conventional aspects, was one of patch-work amendments and temporary adjustments, in an endeavor to apply to changed conditions the principles enunciated by the laws of 1892 and 1910. The results were far from felicitous. None of the so-called commercial treaties concluded after 1919 was of more than a year's duration, renewable every twelve months. It will be observed also that France did not succeed in coming to any new arrangements with the more important powers, and accordingly the pre-war treaties still governed — always on a purely temporary basis — the wider commercial relations. The chaotic situation which resulted from the piecemeal modifications of the tariff and from the numerous different short-term commercial accords with various nations was practically inevitable in the post-war years, when industrial and financial instability made it impossible to arrive at a new stable commercial policy.

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[40] Léonce Janvier, "France's Tariff System and her Commercial Treaties," *Foreign Trade*, November 1927, pp. 809–810.

Nevertheless, there was a well marked tendency toward a fundamental revision of the French tariff and toward a complete readaptation of commercial policy to new conditions. It was realized that neither the pre-war tariff nomenclature nor the pre-war rates, even when modified, were suitable for post-war France, to which Alsace-Lorraine had been added and whose production capacity in the metallurgical, chemical, mechanical engineering and textile industries had been enormously increased. Curiously enough, the new policy was worked out in the commercial negotiations with Germany, whose contractual obligations under the Treaty of Versailles, in so far as trade was concerned, came to an end on January 10, 1925.[41]

In October 1924, at the very outset of the negotiations between France and Germany, the latter country demanded the "most-favored-nation" treatment, which she had been obliged to give to all the Allies, without any reciprocal advantages for five years, in accordance with the terms of the Treaty of Versailles. Since France was pursuing at that time the policy of suppressing "most-favored-nation" clauses in all her commercial treaties, she found this a difficult point to yield. The prolonged discussion on this subject, and the political controversies between France and Germany, and also the French monetary crisis, all delayed the conclusion of any treaty. For many months the two nations traded on the basis of temporary mutual concessions, until finally, on August 17, 1927, a definite convention was signed. The two main features of this treaty were the granting of most-favored-nation treatment by France to Germany and the raising of the Minimum Tariff rates for a great many products. It is estimated that by and large the minimum duties were augmented about 150 per cent under this treaty.[42]

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[41] Treaty of Versailles, articles 264, 265, 266, 267 and 280.

[42] Paul Elbel, "La Réforme douanière et le Parlement," *Revue d'Économie Politique*, March–April 1928, p. 190.

The Franco-German commercial treaty of August 17, 1927, marked, therefore, a reaction against the reciprocity policy enunciated by the law of July 29, 1919, and the return to the "most-favored-nation" clause. In fact, the "most-favored-nation" treatment could not be granted to any one country — particularly to an ex-enemy country — without arousing violent protestations on the part of other countries which saw their French markets imperilled by the new advantages granted exclusively to Germany. Similar concessions had, therefore, to be made by France to the United States, Switzerland, Belgium and Italy.

At the close of 1927 the French Government was preparing a tariff law which, when passed, was to inaugurate a new tariff régime in France. In reality it did little more than generalize and consolidate the tariff arrangements arrived at in the Franco-German negotiations. In order to appease the agricultural interests which found themselves neglected, the duties imposed on farm products were increased very notably, and certain industries which had not benefited under the Franco-German treaty obtained additional protection. The new law was, therefore, still a patch-work of compromises, and not an ideal adjustment to the new economic status of France for which many had hoped. It was more protectionist in its character than any of the preceding tariff laws, and it was built up on the old principle of Minimum and General Tariff schedules. It had one prominent advantage, however: it was intended to inaugurate a new era of stable business conditions which trade requires more than anything else in order to prosper.

Conclusion

Despite the constantly vacillating commercial policy of France during the post-war years, and despite the general economic disorder of the time, French foreign trade prospered and grew, even more considerably than that of most European nations. If the post-war development of French exports and imports seemed extraordinarily rapid, it was due simply to the exceptionally low starting point in 1919. Nevertheless, even when the trade in 1913 is taken as a basis of comparison, it is found that as early as 1924 the pre-war value of exports and imports combined was not only equalled but even surpassed, the trade of both years being measured in terms of francs of the same purchasing power.

The causes of the post-war expansion of French foreign trade are numerous and exceedingly complex. The reannexation of Alsace-Lorraine certainly contributed to swell the volume of the foreign commercial transactions of France; and it is even doubtful whether the 1913 level of trade would have ever been reached again in the period under survey, had it not been for the assistance of the recovered provinces. The shift in the composition of exports towards a greater proportion of manufactured goods, and in the composition of imports towards a greater proportion of industrial materials, may also have been largely due to the additional industrial equipment that came with Alsace-Lorraine. At the same time, the general economic development of the rest of France contributed to this result. And unquestionably monetary inflation affected both the total volume and the composition of French exports and imports, for while it did not always directly stimulate exports or discourage imports, it accelerated internal trade and industrial activity, thus increasing the necessity of importing larger quantities of industrial materials and of exporting manufactured articles in exchange. Among the other factors exercising an important influence on French post-war progress in foreign trade and particularly on the changing balance of trade were the loss of French foreign investments abroad and the fluctuations in the various items of the balance of accounts.

With the stabilization of the currency, it is probable that an important stimulus may eventually be lost, even though the results for 1927 show no decline in exports, but, on the contrary, an increase over the preceding years. France will have to face keen commercial competition from other European nations, and she will no longer be aided by the low gold prices of her exports resulting from the depreciation of the franc. Moreover, the French volume of trade is likely to be adversely affected by the high protectionist tariff rates established at the close of the period studied. On the other hand, these various detrimental influences will, in all probability, be largely offset by the various general tendencies toward the stabilization of trade conditions in Europe. The high rank attained by post-war France among the trading nations of the world may be definitely consolidated and rendered more or less permanent by the continued development of her underlying industrial structure and, thanks to the advent of international cartels, by the more orderly division of foreign markets among the principal competing nations.

CHAPTER XVIII

THE COMBINATION MOVEMENT

1. INDUSTRIAL COMBINES PRIOR TO 1919

THE industrial combination movement, which is proceeding apace in France, as in other economically advanced countries, is not a new post-war departure, nor a foreign importation. When it is announced that the leading French chemical firms have formed a central national committee for the defense of their common interests, or that the principal manufacturers of artificial textiles have organized a common sales agency, or that a phosphate company has bought a controlling interest in a hydro-electric company in order to manufacture synthetic nitrogen for combined fertilizers, these are so many evidences of the continuation of a strong economic trend which had made its appearance in France long before the war.

As early as 1877 the French Lorraine ironmasters formed a common sales agency known as the *Comptoir de Longwy*. Its success led to the establishment of similar sales agencies for other metallurgical products such as axles, springs, girders, and sheet iron from 1892 on. Manufacturers' organizations and syndicates for the regulation of prices and for the division and control of markets were well known before the war, especially in the pharmaceutical products, stone-ware pipe, and book publishing industries. Fusions and amalgamations took place in the electrical apparatus and chemical industries and particularly among the important urban companies distributing gas and electricity.

One could go still further back and find earlier instances of industrial combinations in France.[1] In 1810, oddly enough in the very year that articles 419 and 420 of the Penal Code were promulgated to repress commercial coalitions, the concessionaires of the Rive-de-Gier coal mines organized a really modern type of cartel with a central fund to compensate less favored enterprises and to keep prices from falling. This cartel proved to be only a preliminary step to the formation in 1845 of a regional coal trust, known as the *Compagnie Générale des Mines de la Loire*, which had absorbed not only all the mining concessions of the Loire Valley, but even the canals and other means of transport connected with these mines. Thus with the earliest manifestations of modern industry in France there appeared an inherent tendency to combine and form ever larger business units. France did not have to wait for Germany to point the way to cartels, nor for the United States to set the example of trusts. These forms of business organization are part and parcel of industrial development. If later on they took on more impressive proportions across the Rhine and across the Atlantic, it was only because economic progress was greater after 1870 in the United States and in Germany than in France.

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[1] Léon Mazeaud, *Le Problème des Unions de Producteurs devant la Loi française* (Paris, 1924), pp. 18–19.

The new French combinations which have been formed since the war are in some respects far more significant than their prewar prototypes, not so much on account of the results achieved, as in consequence of the more intense industrial environment in which they are developing. In their international relations, these recent combines show how expanding business units are bursting the shell of national frontiers and tariff barriers. The business men of the world are uniting. Governments which bear the responsibility of keeping intact national integrity, both economic and political, far from opposing the movement, actually aid and abet it. This is seen in the more or less direct part played by various governments in the negotiations for the continental steel combine:[2] and the Franco-German potash agreement was, as will be seen, negotiated under government auspices.

Before describing the various forms and aims of industrial combinations which have come into being as an integral part of the contemporary phase of economic evolution, it is necessary to mention one manner of combination which is, in fact, fast disappearing as a consequence of the more recent developments in industry. In the early eighties of the last century two French metallurgists, with the aid of several Paris banks, succeeded in making three-year contracts with the principal copper mine operators for huge deliveries of copper on condition that these operators accept no other customers.[3] At first the scheme succeeded: no copper could be purchased outside of this group, and the price which had been previously declining rose over 100 per cent in a single year. Then consumers of copper found that modern industry could furnish other cheaper metals which would do as well, and so they ceased buying copper at preposterous prices. The monopoly collapsed. Ruin overtook the promoters. A well known financier backing them committed suicide. Such purely speculative combinations (known as pools, corners or rings), though as old as commerce itself, are now likely to fail. Modern progress in means of communication has widened markets to such an extent that it has become almost impossible to seize anything like a complete supply of a commodity for the purpose of making a fortune through a single deal. Furthermore, with the constant multiplication in the number and variety of commodities manufactured and offered, it is relatively easy to find a substitute for the monopolized article.

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[2] Louis Domeratsky, "International Industrial Combinations," *U. S. Department of Commerce Reports*, Dec. 27, 1926, pp. 789–800.

The Technological Foundations of Modern French Combinations

Modern vast industrial combinations, both national and international, have little in common with monopolistic experiences belonging to an earlier stage in industrial development, the occasional recrudescence of which simply reveals once more that the past dies hard. The newer forms differ from the old, not only in their economic and legal structure, but in their avowed aim and proposed duration. Especially after the war, in a period fraught with difficult problems of adjusting production to consumption and tortured by general financial demoralization, industrial combinations were less and less regarded as public dangers, and in many quarters were looked to as instruments of economic salvation.[4]

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[3] Mazeaud, *op. cit.*, pp. 32–34.

[4] Grossman, *Methods of Economic Rapprochement* (Geneva, League of Nations, 1926), Paul de Rousiers, *Cartels and Trusts and their Development* (Geneva, League of Nations, 1927), Weidenfeld, *Cartels and Combines* (Geneva, League of Nations, 1926).

Whether one is inclined to condemn all understandings between manufacturers, as contrary to principles laid down by Adam Smith[5] or as detrimental to the interests of the laboring and consuming classes, or whether one sees in them the panacea for all economic and social evils, the very multiplicity of these unions before, as well as after, the war would seem to indicate that they are normal phenomena in present-day economic society. For the most part, modern industrial combinations are products of the force of circumstances rather than deliberately planned sinister intrigues.

The very term cartel (or kartell) which is used to designate one of the forms of combination most prevalent in Europe for the last sixty years offers a clue to the conditions which give rise to these organizations. Referring originally to the terms of combat to which prospective duellists agree, and later to arrangements between belligerent nations for the exchange of their prisoners of war, the word cartel came to be applied in Germany to agreements between competing firms for the regulation of prices, the fixing of production quotas, the division of markets, the exchange of patents, etc.

The transference of this word from the realm of private and public war to the realm of economic competition was indeed most apt. With the rise of giant enterprises, particularly in such key industries as the metallurgical and chemical industries, the old mortal combats which used to characterize competitive business relations in the first stages of the industrial revolution could not subsist. Before the dawn of the iron age, when diminutive charcoal furnaces could satisfy the meager needs of the day, it is obvious that metallurgical enterprises could rise and fall, as a result of the normal play of competition and of the fluctuations in demand on the market, without affecting very much the prosperity of a wide community. But when the great blast furnaces of Lorraine were constructed at tremendous expense, following upon Thomas's and Gilchrist's discovery of a way of smelting phosphorous ores, these powerful engines of production were found to embody too many vital interests, both social and private, to be left at the mercy of a fickle market. Once lit, blast furnaces must go on devouring tons upon tons of coke and ore in a constant flame that burns from morning to night and from night to morning. They may be banked down and brook a delay of two or three months, but that is all. The extinction of the fires brings with it the loss of employment and means of livelihood to thousands of workers, not only in the metallurgical plants, but in coal and iron mines, in limestone quarries, in coking plants and in a host of other related industries. The cooling of a blast furnace involves no less a disaster to the financial interests concerned: investors, bondholders, and banks all suffer when the periodic "tapping" of incandescent iron ceases. The ruin of a bank, the broken fortunes of capitalists, and the reverses of an ironmaster are by no means isolated misfortunes and mere private matters, for the failure of one big enterprise often entails the downfall, or at least a rude shaking, of other establishments with which, directly or indirectly, it is financially bound up. The prosperity of the whole industrial community is thus built on a new technical necessity — a sort of industrial "categorical imperative" — that of keeping the blast-furnace flame burning.

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[5] This point of view is eloquently exposed by Gustav Cassel in *Recent Monopolistic Tendencies in Industry and Trade — being an analysis of the nature and causes of the poverty of nations* (Geneva, League of Nations, 1927).

The ironmasters of Lorraine were not long in perceiving the general solidarity of their interests, particularly in view of the fact that their product, pig iron, derived from phosphorous ores, was still looked at askance by the metal trades. Accordingly, they constituted very early — in 1877, as has just been seen — the *Comptoir de Longwy*.[6] The participants combined not only in order to form a common sales agency which would have an exclusive right to sell their products at its own terms, but also for the purpose of limiting production by assigning fixed quotas to each member, since foreign competition was threatening to glut the French market. Thus large scale metallurgical enterprises, weighed down with the responsibility of important fixed plant equipment, were forced to surrender large portions of their economic sovereignty, such as the right to sell as they pleased and the right to produce as they pleased.

The underlying cause of the rise of business combinations in the metallurgical industry was technological. It was the discovery of the use of coke for smelting and the practical application of the Thomas and Gilchrist process that made possible a rapid and almost unlimited expansion in production without building up a corresponding capacity for absorption. Technological progress lay at the basis of the modern combination movement in other industries too. When soda could be extracted only from wood ash in minute quantities so that demand always exceeded supply, independent manufacturing units could go on happily and compete as freely as the disciples of Adam Smith might wish. When, however, Leblanc and later Solvay discovered a way of making soda in practically unlimited quantities, then combinations and fusions quickly eclipsed free competition. Likewise in the dyestuffs industry, so long as the only source of coloring matter was wood, indigo and madder root, then small independent manufacturing units were the rule; but with the discovery of chemical methods for making dyes from inexhaustible raw materials it was found that only collosal enterprises could set up the required fixed plant, and these could live only in an atmosphere of mutual coöperation and harmony, attained by the sacrifice of some of their business independence.

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[6] Mazeaud, *op. cit.*, pp. 21–23.

In the course of the three or four decades which immediately preceded the war, France, like all other countries which were undergoing the process of constant industrialization, had her measure of industrial combinations. That very measure, and the more or less rigid forms which French combinations took, were functions of the status and peculiar circumstances of France's industrial development at the time. If the French *comptoirs* ruled their participants with an easier hand than the German cartels, and if they exercised less arbitrary power over the markets they controlled, it was probably because the progress of industry in France was less intense than in Germany, and the danger of creating unwieldy productive organisms, which might produce more goods than could be profitably disposed of, was less acute. The current French explanation that the brutal American trusts and the strictly disciplined German cartels find no counterpart in France because the soul of the French race is made of too gentle stuff [7] must be taken *cum grano*. In France, as everywhere else, business will push its advantages to the utmost, and charge what the traffic will bear. Certainly that was the guiding principle of the *Comptoir de Longwy* (Lorraine pig iron), the *Comptoir des Essieux* (axles), the *Comptoir des Ressorts* (springs), the *Comptoir des Poutrelles* (girders), the hematite pig iron cartel, the *Comptoir des Toles et Larges Plats* (sheet iron and steel plates), the phosphate entente, the white lead cartel, the Lyons velvet ribbon combination, and the cotton yarn export *comptoir* of the north — to mention only a few of the many cartels that flourished in France before the war.[8]

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[7] Lapergue, *Les Syndicats de Producteurs en France*, p. 129.

However unlike other business men the French may be in their psychological make-up, the difference was certainly not great enough to prevent them from participating in many important pre-war international cartels and *ententes*. French industry was prominently represented in such powerful international groups as the rail, the girder, the munitions, the bottle and the dyers' cartels.[9] Membership in these international combinations presupposes a fairly well consolidated national organization, capable of enforcing the terms of international agreements.

The pre-war combination movement in France was nevertheless notoriously weak and poorly developed in comparison with the corresponding movement in other industrial countries. The powerful combinations of America (particularly in oil and tobacco), of England (in cotton thread, wall paper, bedsteads and other ironware), and of Germany (in coal, coke and chemicals) were menacing French industry on French soil as well as on the international market. The efforts of France to build her own cartels capable of facing these foreign groups on terms of equality is part of the post-war story.

The war proved to be at one and the same time both destructive and stimulating to the combination tendency. It put an abrupt end to international cartels, especially those of which the members found themselves in opposing camps. It took the wind out of the sails of the movement towards agreements between manufacturers, for they ran no danger in war-time of producing beyond profitable demand. The industrial combinations which the war stimulated were of a peculiar nature, and arose rather to meet the extraordinary exigencies of the situation than as part of the normal evolution of industry. At a time when military success and national existence depended on a regular and ample supply of munitions, army supplies, foodstuffs and a modicum of commodities for the civil population, the responsible belligerent governments felt that they could not leave the production and circulation of these goods to the whims of "the laws of nature." They undertook, therefore, to persuade and, where persuasion proved ineffective, to compel industrial enterprises to form unions, known as "consortiums."

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[8] Mazeaud, *op. cit.*, pp. 18–71.

[9] *Ibid.*, pp. 103–105.

These war-time combinations, under close surveillance of the State, controlled, on a national scale, not only production and importation, but the distribution of raw materials and manufactured goods indispensable to the life of the community.[10] The State decreed itself sole purchaser of certain basic commodities, such as coal, oil, iron, chemical products, wheat, means of transportation, etc., which it required in excess of the pre-war supply. It thus avoided facing a multitude of independent competing units at a time when competition would have raised prices to a speculative level. Furthermore, since domestic production was rarely adequate and constant recourse was had to imports, the consortiums, as collective institutions, helped to consolidate credit abroad. All these circumstances clearly show that the war-time combinations, though they represented an interesting, and more or less successful, effort to rationalize economic life, were bound to disappear with the cessation of hostilities. In fact, when the war was over, their very *raison d'être* — insatiable governments clamoring for ever increasing supplies of war materials — vanished.

2. INDUSTRIAL COMBINES AFTER THE WAR

When peace returned the old industrial combinations which had been lying dormant during hostilities revived. And well they might. Had not the war and the Treaty of Versailles created for many key industries new and enlarged production capacities which only agreements between manufacturers could regulate, if supply was to be prevented from exceeding the reduced peace-time demand? Hardly had the echoes of cannon thunder died away, when the French Government realized that the reannexation of Alsace-Lorraine and the temporary inclusion of the Saar within the economic frontiers of France would endow her with a superabundance of steel plants. If allowed freely to compete, the smaller and less favorably situated firms would be irretrievably crushed. Classical economists might then have had an occasion to marvel once more at the wisdom of nature in bringing about so perfect, though painful, a readjustment of supply to demand. The French, however, were at that time interested in keeping their steel plant equipment intact, lest their former enemies or other foreign competitors steal a march upon them, and deprive them of some of the economic advantages which had come with their hard won victory.[11] Accordingly the Government itself in 1919 instigated the revival of the old *Comptoir des Poutrelles*, which was rechristened *Comptoir Sidérurgique*, because it controlled the sales of other steel products, such as u-bars, as well as of girders. The Government even granted allowances from the public treasury to certain constituent firms whose factories were operated at too high a cost. Their elimination would have entailed a reduction in the supply of steel, a rise in prices, and, as a consequence, insurmountable difficulties for the elaborative metal trade industries which were already suffering from the brusque stoppage of the war demand. The new steel combination, working in coöperation with the Government, thus eased the transition from war-time to peace-time production.

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[10] Lapergue, *op. cit.*, pp. 145–146.

The *Comptoir de Longwy*, too, returned to life with the reëstablishment of peace. It was immediately faced with a situation so novel and requiring so many constant readjustments that this oldest surviving French *comptoir* soon succumbed. To the pre-war French blast furnaces, which in 1913 had produced over five million tons of pig iron, and which came out of the war partially crippled as a result of the devastation in the north, were added new blast furnaces built during the war, away from the battle lines, with a capacity of 600,000 tons per year.[12] That was not all, for Alsace-

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[11] Lapergue, *op. cit.*, pp. 153–158.

[12] Ministére du Commerce, *Rapport générale sur l'Industrie française*, (Paris, 1919), Vol. I, p. 80.

Lorraine possessed 66 blast furnaces and the Saar 29, which in 1913 had produced respectively 3,870,000 tons and 1,375,000 tons.[13] The pig iron production capacity of France was thus at least doubled after the war. As has already been seen, the growth in consumption capacity lagged far behind this increased supply.[14] Was not this an ideal situation for the encouragement of a strong combination movement within the industry? Supply clearly exceeded demand; and a united effort, rather than dispersed endeavors, was required in order to capture adequate foreign markets to take the surplus. And yet the *Comptoir de Longwy*, in spite of its years of experience, failed in the task. Why?

The circumstances which led to the dissolution of the *Comptoir de Longwy* are the more interesting to examine in detail, because a number of other combinations disintegrated within a few years after the war for analogous reasons.[15] The *Comptoir de Longwy* functioned not only by serving its members as a common and exclusive sales agency, but by assigning production quotas to each in proportion to its respective capacities. Even under the relatively normal pre-war conditions the distribution of quotas was a very delicate business. Under the very unstable conditions of the years immediately after the war, however, the negotiations proved impossible. They were complicated, for example, by the necessity of gaining the adherence of enterprises formerly German which had just come within the French national boundaries, for a price-fixing combination can only succeed if it controls a large part of the domestic production. All sorts of legal and administrative obstacles, in the shape of sequestration measures, lay in the way at first. When finally the German blast furnaces passed into French hands, the lack of capital and the difficulty of obtaining coke and other supplies delayed their resumption of activities. At the same time a number of the old French plants which had been more or less completely destroyed in the course of hostilities were being gradually rebuilt. As soon as they were ready to produce again they began negotiating with the *Comptoir* with regard to their quota.

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[13] *Ibid.*, Vol. II, p. 969.

[14] See above, Chaps. XI and XII.

[15] Lapergue, *op. cit.*, pp. 197–198.

Since their new equipment generally possessed an increased productive capacity, they naturally demanded a correspondingly larger quota. But where were their additional products to go? Domestic consumption was moving upward but slowly. Foreign markets were hard to find. Adequate quotas could, therefore, be assigned to these reconstructed plants only if other firms, including those in reannexed Lorraine and the Saar, would consent to compensatory reductions in their quotas. This they refused to do, and the *Comptoir de Longwy* had to close its doors in 1921.

The causes of the dissolution of the *Comptoir Sidérurgique* point to a significant factor in post-war economic evolution.[16] Here, indeed, is an unequivocal instance of the inadequacy of national combinations, when once an industry has become so internationalized as the steel industry. One of the member companies of the *Comptoir Sidérurgique*, the *Société des Hauts Fourneaux de la Chiers*, in reality a Belgian firm, whose factories literally straddled the Franco-Belgian frontier, claimed a double quota, because, it maintained, it had markets for its products in Belgium as well as in France. This obviously meant that the La Chiers plants would be working at full capacity on a relatively low cost of production basis, while most of the other adherents of the *Comptoir* with part of their equipment in a state of forced idleness as a result of their reduced quotas, would be paying useless overhead charges and high production costs that generally accompany limited output. The purely French steel plants in the combination had already been placed in a similarly disadvantageous position with respect to the Saar firms, which in April 1922 had demanded that the quotas assigned to them apply only to their production for the French market, and that they be free to produce without restriction for their other markets, which were principally German.[17] When, at the close of 1922, the La Chiers firm refused to modify its position, it proved to be the last straw, and the *Comptoir Sidérurgique* broke up.

In a similar way, from 1921 to 1923, the *Comptoir des Tôles et Larges Plats*, the *Comptoir des Fontes Hématites*, the *Comptoir des*

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[16] Lapergue, *op. cit.*, pp. 198–201.

[17] Mazeaud, *op. cit.*, p. 29.

Essieux, the *Comptoir des Ressorts*, etc., all went down in defeat before the problems which the unstable post-war conditions raised. What did this holocaust mean? Did it signify that industrial combinations were, after all, poor instruments for the adjustment of production to the market, when supply exceeded demand? In the case of the *Comptoir Sidérurgique*, obviously the steel industry had too many international ramifications to permit production to be regulated on an exclusively national scale. There were, also, purely domestic causes which brought about the dissolution of the steel and other combinations. The post-war situation favored some firms and proved disastrous to others. Many formerly prosperous metallurgical companies clung desperately to the pre-war combinations as their only salvation. The more favored firms, on the other hand, saw their chance to expand and to absorb the business of their hard pressed competitors, and lost patience with the quota system and with the formulae of a more or less equal distribution of losses. The new lions would not lie down with those that had fallen to the state of lambs. In other words, a period of fusions, amalgamations and absorptions, that is, of business concentration, set in. After the war, as before the war, combination agreements were viable only between equals. Time had to be allowed for a new set of equals to appear. There was nothing antagonistic in this to the combination movement.

Business Concentration and the Combination Movement

The growth of big business by merger and consolidation, which is a necessary preliminary to combination, is precisely one of those trends which characterized the whole post-war period of French industrial evolution. The movement undoubtedly had its roots in the tendency toward industrial concentration which had been steadily increasing in scope and intensity every since the introduction of the factory system. The war simply quickened the pace of these trends. Unfortunately only very scattered data are available concerning the more veiled post-war business concentrations of France.

An interesting study has, however, been made of the most important instances of business combination effected in France during the war, through the open and outright purchase of one corporation by another.[18] The principal motive was found to be the desire for greater efficiency in production which generally results from the union of several plants under a common business control. Another powerful incentive was the general economy in costs which could be realized through vertical integration, as when a manufacturing firm either absorbs a power plant from which it has been accustomed to purchase electric current, or buys up an independent factory from which it has been deriving its partially elaborated raw materials. These numerous war-time fusions were to have been expected only when intensive and highly organized production was called for. It is not surprising that the principal industries involved were the engineering, electrical and chemical industries.

As soon as the war was over, the reconstruction period gave rise to new concentrations which spurred on the combination movement. The destruction of coal mines, chemical plants, textile mills, metallurgical factories, etc., in the devastated north resulted, in final analysis, in a liquidation of the demolished fixed capital. Reparation claims took the place of ruined factories. This situation offered an exceptional opportunity for industrial concentration. The larger firms, for example, suppressed their weaker rivals by purchasing the latter's claims, and thus preventing a host of small plants from rising from their ashes. On the reëstablishment of peace many powerful companies, which before the war had been compelled by their separate technical equipment to compete with each other to their mutual disadvantage, found occasion, thanks to the destruction of their plants, to unite their liquid funds, build a single giant factory, and thus gain control of the market. In this way, for instance, the *Forges et Aciéries du Nord et de l'Est* absorbed in 1919 the *Laminoirs et Usines de l'Espérance*, and the *Société des Mines de Houille de Vicoigne et de Noeux* united with an equally powerful coal mining company, the *Société des Mines de Drocourt.* This manner of concentration, peculiar to the immediate post-war period, was especially notable in the French sugar refining industry where the number of firms fell from 33 in 1914 to 25 ten years later. Four of these (Say, Lebaudy, Sommier and Beghin) control to-day practically the whole of the country's sugar production.[19]

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[18] Pierre Caboue, "La Concentration des Entreprises en France de 1914 à 1919," in the *Revue d'Économie Politique*, July–August 1920, pp. 479–488.

The breakdown of the old combinations in the metallurgical industry was due, as has been seen, to the chance the larger firms saw of increasing the size of their business units. In 1919 and 1920 the principal French iron and steel companies outside of Alsace-Lorraine effected a series of immense absorptions and coalitions, the net result of which was to bring the bulk of metallurgical production within the orbit of a few dominant firms. It is no secret, for example, that the Schneider and de Wendel concerns joined forces in the Joeuf and Knutange undertaking for the manufacture of iron and steel in its cruder stages.[20] The Schneider establishments, of which the main works at Le Creusot and at Le Havre were engaged in the manufacture of armaments, engines and engineering products, actually owned outright or had more or less important investment interests in coal and iron mines, not alone in France, but in Germany, Belgium, Poland, Austria and Czechoslovakia. Its participations in blast furnaces and steel works are also very widespread. There was, in fact, hardly a motor or automobile company, an electrical apparatus concern, a locomotive building works, or a factory for scientific instruments in France with which the Schneider firm was not in some way connected. Its influence extended far beyond France, for its head was also president of the *Union Européenne Industrielle et Financière*, a holding company wielding financial power over numerous banks and industries in central and eastern Europe. The Schneider interests stretched even to Chile, Argentina and North America. This company was the most powerful among several other French metallurgical firms which were all concentrating their financial power at home and extending their control abroad. The *Fives-Lille* machine construction company, for instance, had holdings in the Santerre refinery for which it erected a complete modern sugar factory.

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[19] Mazeaud, *op. cit.*, p. 57.

[20] Cahill, *Report on the Economic and Industrial Conditions in France, to July, 1925*, pp. 215–225.

In the coal, as in the metallurgical industry, there was a notable increase after the war in the size of business units. The development of the *Société Civile des Mines de Lens* in the devastated north is a striking example of business concentration resulting from the absorption of reconstruction claims.[21] New technical factors exercised an important influence on the movement. It required larger business units to install newer technical improvements, such as electrical coal-cutting appliances, rapid shaft elevators, etc. Furthermore, French collieries, like collieries the world over, were extending their manufacturing interests beyond mere coal digging. Their competitively determined costs of production were no longer based solely on the extraction of coal. They generally attached to the mines central thermo-dynamic generating plants producing electrical energy not only for their own use, but for the industrial and domestic needs of the surrounding region. The notable development of the coal-tar products chemical industry in post-war France led to a great many business alliances between coal companies and chemical producers. The Anzin Mining Company and the Kuhlmann chemical firm formed in 1925 the *Société de Produits Chimiques Anzin-Kuhlmann* for the purpose of extracting hydrogen from coke-oven gas, the preliminary step in the manufacture of synthetic ammonia. Thus coal mines were technically, and therefore financially, linked at one and the same time to metallurgy, industrial chemistry and the generation of thermo-electric power.

It would be an endless task to list the numerous manifestations of business concentration in France. Suffice it to say that the movement was most conspicuous during the post-war period in the following industries: bauxite extraction, aluminium, the production and distribution of electricity, the manufacture of glass, chemicals, paper, rubber products, moving-pictures and textiles, besides coal, iron, engineering and sugar industries already mentioned.[22]

Informal Combinations

The new highly concentrated business units, the rise of which after the war was coincident with the dissolution of the older formal combinations, remained at no time completely aloof from each other. In view of their multiple interlocking financial and technical interests, it is not surprising that they maintained connections through some form of organization. In place of the defunct *comptoirs*, there arose immediately a number of more or less secret *ententes*, or gentlemen's agreements, between the more important producers. They were informal combinations which proved to be very well suited to the economic conditions that prevailed in France from 1923 on, especially in the metallurgical industry in the east of France.

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[21] Cahill, *op. cit.*, pp. 197–215.

[22] Cahill, *Report, 1925–1926*, p. 249.

In times of business expansion, when the growing, independent, big concerns would not brook any limitations to their economic sovereignty by a collective and binding contract, these loose *ententes* kept alive the central idea of common agreements as to the purchase of raw materials, the regulation of prices, the division of markets, the establishment of uniform sales conditions, etc. These agreements had to be elastic, modifiable at the request of any member at short notice, sometimes effective, sometimes dormant — just as the changing situation required. Although they did not prevent the merciless crushing or absorbing of smaller units, informal combinations succeeded in preventing cut-throat competition from cropping up between big businesses.

Besides tacit *ententes*, which show a remarkable resemblance to the "Gary dinner" combinations in the United States, other new kinds of producers' organizations arose, all more or less similar to the American trade associations. The *Comptoir du Carreau de Grès* (sandstone tiles), though still maintaining the old designation of *Comptoir*, is an interesting example of the most recent orientation in the French combination movement.[23] It undertook no regulation of the production activities of its members, nor any control of their prices or sales operations. Its principal object was simply to set up an information bureau, a sort of central statistical office, to which the adherents of the *comptoir* forwarded detailed information concerning their sales and prices. Qualified specialists were to tabulate the data sent in, and indicate the fluctuations in market conditions for sandstone tiles in each geographical division of France. This digested information was then published and sent out to the members of the *comptoir* who were thus supplied with a guide enabling them to determine intelligently their manufacturing and commercial policy. Furthermore, the members held meetings every month to discuss the general situation. They naturally arrived at certain decisions as to prices, apportionment of markets, and organization of production. But no one was bound by any contract, and each was free to follow or not to follow the dictates of common wisdom collectively determined. Experience in France, as in America, showed these looser combinations to be very effective.

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[23] Lapergue, *op. cit.*, pp. 205–210.

These reformulations of the combination policy in France responded admirably to the particular industrial conditions arising from monetary inflation. What stimulation of exports resulted from the fall in the exchange value of the franc created an outlet for some of the excess production capacity of France. The fact that looser forms of combination became dominant simply meant that a stringent limitation of production was, for the time being at least, not required. The question arises whether the stabilization of the franc may ultimately lead to depression in industry and a consequent recrudescence of *comptoirs* and other contractual quota combinations.

3. International Forces Stimulating the Combination Movement

Often where local and national conditions are not conducive to the formation of any kind of combination, whether contractual or informal, in a given industry, or where they even tend, for a time at least, to check and destroy the movement, forces sometimes arise from without which compel independent manufacturers to come to terms with each other. Such a force may be, for example, the threat of foreign competitors to wean away export markets. In the post-war French textile industry numerous factors militated against combination,[24] for the lack of homogeneity in the commodity manufactured makes a common sales and manufacturing policy most impracticable. In view of the fact, also, that production, in most textile branches, had only just about reached its pre-war level by 1926, and that at the same time inflation made it easy to obtain foreign outlets, there was no visible reason why the manufacturers should feel impelled to abdicate any of their economic independence for a common cause. Still French manufacturers were led to create collective advertising and selling organizations for their wool and cotton exports, because they were aware that the rehabilitated industry of Germany and the well established English cotton mills were lying in wait to recover foreign markets as soon as the stabilization of the franc leveled up French internal costs of production.

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[24] See above, Chaps. XIII and XIV.

In the metallurgical industries, as in the textile industries, post-war conditions did not favor combinations. This was clearly indicated by the disruption of several *comptoirs*, the existence of which was not compatible with the readjustments and concentrations of certain firms at the expense of others. Furthermore there always had been in the French metallurgical industry a psychological atmosphere opposed to contractual business unions, because the more powerful steel and iron concerns were almost all patrimonial estates, the owners of which, in each generation, felt it their bounden duty to maintain the complete independence and individual characteristics of the firm. Nevertheless there were international forces in economic life which overrode such personal predilections. Business combinations, like business concentrations, were matters of competitive necessity rather than matters of choice. How could scattered French steel firms — no matter how powerful each one might be — hold their own even on French soil against the united force of the gigantic steel combinations which were looming up across the Rhine in Germany and across the Atlantic in the United States?

The principal French metallurgical concerns had never really shut themselves up in isolated fortresses of complete economic independence. Even at times when national competition was too keen to permit the survival of the various *comptoirs* for steel and iron products, the rival metallurgists always had their businessmen's club, so to speak — their *Comité des Forges* — which kept them closely knit together by bonds of common interest. The most important common problems facing the French metallurgists were essentially international in their nature. The whole industry was vitally concerned with the difficulty of obtaining coal and coke from abroad. It was no less a matter of life and death for the industry to find markets for its products, and this too was an international undertaking. The French metallurgical industry was involved in constant negotiations with such formidable foreign combinations as the *Vereinigte Stahlwerke* of Germany and the *Arved* of Luxembourg. It was the *Comité des Forges* which at all times incarnated the needed united front.

The *Comité des Forges* was founded in 1864. In 1888 it took on the legal form of an employers' association (*syndicat professionel*), the functions and powers of which were limited and defined by the law of 1884. It is important to observe that such organizations have no right to transact any commercial business, the law expressly forbidding them to engage in any form of activity other than that connected with the simple defense of their economic, industrial and commercial interests. The *Comité des Forges* must not, therefore, be confused with the various French metallurgical *comptoirs*, cartels and trusts which were not associations but corporations. Nevertheless, by its constant and vigorous intervention as a mediatory agent, the *Comité des Forges* proved to be the greatest force in France for combination in the metallurgical industry. It was under its aegis that practically all the pre-war steel and iron product *comptoirs* had been founded. During the war the *Comité des Forges* ceased to be an ordinary employers' trade union, and became at the request of the Government a vast consortium exercising dictatorial power over the metallurgical industry of the entire country.[25] On the reëstablishment of peace it shed its mantle of absolute authority and returned to its ostensibly more modest rôle. Still the *Comité des Forges* continued to inspire tacit and local *ententes* in the industry when the contractual organizations broke down under the strain of post-war readjustments. In meeting the redoutable international problem which arose, the *Comité des Forges* played quite frankly the part of a national metallurgical combination.

[25] Robert Pinot, *Le Comité des Forges de France au Service de la Nation.*

International Steel Agreement

The mechanism by which world economic conditions brought about a strong national combination in the French steel industry may be seen in the circumstances which gave rise to the International Steel Agreement. The steel market came to a very critical turning point in 1925, when the world production of steel not only attained the 1913 production level for the first time since the war, but actually surpassed it by about 19 per cent.[26] The increase did not take place in Europe, however, but on other continents: in North America (37 per cent increase), in Asia (five-fold increase) and in Australia (thirty-three-fold increase). Europe's 1925 raw steel output was still short of the 1913 figure by over 6 per cent. The development of the industry in non-European countries, which was enormously stimulated by the war, meant that so many former outside markets for European steel were closed to any further notable expansion. This was particularly unfortunate for the European steel producers because the war-time armament demands and the post-war economic rivalries resulted in a great increase of the European steel production capacity. At the same time the consumption capacity of the principal countries of Western Europe had diminished,[27] which severely aggravated the difficulty.

The waves of monetary inflation giving temporary competitive advantages now to Germany, now to France, and now to Belgium, etc., followed by waves of stabilization which suddenly destroyed these advantages, all added to the chaos. How the generally unstable international situation affected the French metallurgical activity and undermined the domestic combination movement has been seen in the account of the dissolution of the *Comptoir Sidérurgique*. Whatever the French national tendency might have been, the international situation was calling for combination if disastrous cut-throat competition on an international scale was to be avoided. It was obvious by 1925 that only an international understanding could solve the knotty problem of adjusting European production to consumption, and this solution was not long in coming.

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[26] Source: League of Nations, *Memorandum on the Iron and Steel Industry*, International Economic Conference, Geneva, May 1927, p. 9.

[27] The following table of production capacity was taken from the *Special Report: The Continental Steel Entente* . . . Oct. 4, 1926, by Daniel Reagan, U. S. Trade Commissioner, Paris, citing Bulletins of the 4th and 17th of August 1926 of the Comité National d'Études Sociales et Politiques, 45 rue d'Ulm, Paris. The 1925 production figures were taken from the League of Nations, *Memorandum on the Iron and Steel Industry*, cited above, pp. 13, 33 and 34. As the steel industry produced on orders and

After many months of delicate negotiation the International Steel Agreement was finally signed in Brussels on September 30, 1926. A vast steel combination was created for the coöperative regulation of production in Germany, France, Belgium, Luxembourg and the Saar. At the opening of 1927, Czechoslovakia, Austria and Hungary adhered to the Agreement. The production quotas clearly indicate that here was a collective effort to adjust output to a capacity of absorption that had not increased proportionately with the post-war capacity of production.[28]

That was not all. The complete significance of the international agreement was much wider than the published text reveals. Underneath the stipulation that "each country shall pay one dollar monthly into a common fund for each ton of crude steel actually produced" [29] lay the first signs of a price agreement. Although it was probable that these payments would eventually be returned to each country through the semi-annual liquidation of the common fund,[30] it was also possible that they might be definitely lost

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generally not for stocks, the production figures may be taken as representative of demand.

COUNTRY	ESTIMATED POST-WAR STEEL PRODUCTION CAPACITY (In thousands of tons)	PRODUCTION OF STEEL IN 1925
France	9,750	7,415
Germany	17,000	12,194
England	12,000	7,517
Belgium and Luxembourg	5,750	4,633
Saar	2,000	1,575

[28] For details, see above, pp. 298–302.

[29] Text of International Steel Agreement published in the League of Nations, *Memorandum on the Iron and Steel Industry*, pp. 109–112.

[30] Article 8.

to a given member country, if the fund should be called upon to pay large bonuses to other participating countries for keeping below the quota. In view of this risk, prices would undoubtedly be maintained at a high enough level to cover the automatic dollar-per-ton payment; and thus price cutting, especially by those countries enjoying exchange advantages on the international market, would be to a certain extent checked. Moreover the recompense of two dollars per-ton-unproduced award to countries manufacturing less than their quotas (provided that "the tonnage entitling to compensation does not exceed 10 per cent of the quota") [31] must act as a sort of guaranty of just so much profit per ton, since up to a certain point it would pay a country in the Agreement to refuse orders rather than fill them under conditions yielding less than two dollars a ton net gain.

The suspicion that an implied price *entente* underlies the ostensible quota arrangement is confirmed by the actual movement of prices when negotiations were successfully under way and immediately afterwards. During the first half of 1926 steel exporters complained not only of the sharp competition among the continental producers, but also of the low prices which were generally under those obtained in the interior markets of the various countries. No sooner was it reported that the Agreement was to be launched than prices took an upward bound. While the rise was due partly to the contraction of competition of the British market owing to the prolonged coal strike, observers generally agree that the anticipation of favorable effects of the new international organization also affected decidedly the upward swing.

If credence be given to reports outside the bare official wording of the published statutes, it appears that a supplementary gentlemen's agreement was arrived at with respect to the partition of markets.[32] This would complete the trilogy of conditions required for an effective combination; the regulation of production, the control of prices, and the distribution of markets. The *Comité*

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[31] Article 7.

[32] Reagan, *op. cit.*, p. 2. This is denied in the *Rapport de la Commission de Direction* of the Comité des Forges de France, presented to the general assembly of May 19, 1927, p. 14.

des Forges admits the existence of an understanding with regard to the flow of steel into Germany from Lorraine, the Saar and Luxembourg, which had been formerly within the German customs union. It is reliably reported, furthermore, that France, the Saar and Luxembourg agreed to refrain "from selling a quantity of pig iron and metallurgical products in Germany above a fixed amount which is somewhat inferior to the average exports into Germany during recent years."[33] That is apparently why Germany allowed it to be assumed in article 10 of the Agreement that "the tariff rates applicable to iron and steel products imported into Germany would not be increased." How well balanced was the bargain for the division of the European market is revealed in an additional unpublished arrangement according to which, it is said, each country agreed not to sell in any of the other contracting countries at prices below the domestic quotations of the members. This gives Germany an almost absolute control over her own price level, while assuring Luxembourg, the Saar and Lorraine a high gold level for the contingent allowed for export into Germany.

Of what import was this International Steel Agreement to France? At the time it was signed, the foreign market for French steel products threatened to shrink because of the sudden rise in the gold value of the franc. The quota arrangement gave France assurance that her rivals would not profit at her expense. And far more significant than this problematical immediate advantage was the fact that the Agreement was unmistakable evidence that France and Germany were arriving at a compromise which would resuscitate the Lorraine-Ruhr industrial coöperation. The complementary pacts regarding the German tariff on iron and steel,[34] and regulating the quantities of Lorraine steel products which were to be exported into Germany, constituted, in effect, a modified prolongation of articles 68 and 268 of the Treaty of Versailles of which the avowed object was to avoid a brusque catastrophic separation of the reannexed territory from Germany.

Furthermore, the fact that the Agreement contains the germ of an arrangement for the division of foreign markets is of especial significance to France, since the French steel industry must rely on exports for the disposal of much of its output. Certain incidents in the very early history of the Agreement reveal a tendency in the direction of an apportionment of export trade. The terms of the Agreement placed Germany in a sore plight in the first half of 1927, when her own internal demand called for a volume of steel production far exceeding her quota, and consequently involving her in heavy payments of four dollars per excess ton. The members to the Agreement were then led to modify their policy with respect to these fines.[35] There is only a step from this change to the partition of foreign markets, leaving the internal markets free to each participant.

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[33] Reagan, *op. cit.*, p. 18.

[34] See above, pp. 298–299.

From the point of view of the general development of the combination movement in France, the successful launching of the International Steel Agreement is perhaps the most important event in post-war years. From 1921 to 1925 the lack of coherence in the metallurgical industry was notorious. In March of 1925, however, the *Office des Statistiques des Produits Métallurgiques* was formed, at first with the sole object of setting a minimum price for certain iron and steel products. The purpose was changed in October of the same year to the regulation of production. The International Steel Agreement could have no other effect than to consolidate this tendency. It is impossible to conceive of the existence of an international pact governing production and, more indirectly, price and markets, without a strong national combination capable of carrying out the terms of the Agreement.

Other International Agreements

There was nothing particularly novel in the International Steel Agreement. To be sure, its prototypes are not to be found in the old international trusts like the Standard Oil or the Royal Dutch, which were, in reality, expansions of national combinations beyond their home frontiers. The Steel Agreement consisted rather of a union of separate national combinations, and thus resembled the

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[35] *Journée Industrielle*, June 11, 1927. According to information communicated by the U. S. Trade Commissioner at the American Embassy, Paris, Germany exceeded her quota in December 1926 by over 25 per cent. Her fines paid to the common fund up to January 1, 1927 amounted to $2,690,000.

International Rail Makers Association (*Irma*), founded in 1904 and dissolved ten years later at the outbreak of the war. This latter association was reconstituted on March 11, 1926, no longer as the *Irma*, but as the *Erma* (European Rail Makers Association), that is, with the United States ostensibly left out. Both in its old and in its new form it had all the earmarks of an international combination for the regulation of foreign sales and prices, its real purpose being to maintain prices at a level where everyone could make a profit. From 1904 to 1926 there were notable changes in the proportional export trade quotas assigned to each of the members, as the following table shows:

Country	*Export trade percentage quota 1904*	*Export trade percentage quota 1926*
Great Britain	37·78%	43·0%
France	3·39	19·5
Belgium	12.47	11.0
Luxembourg	20.36	7·0
Germany		19·5
United States	26.00	—

The extraordinary advance of Great Britain in 1926 gives an air of probability to the rumor that the 43 per cent tacitly included the quota of the United States, the rail manufacturers of which came into the Association secretly in order to escape prosecution under the American anti-trust laws. The French six-fold increase is presumably genuine, and simply reflects the highly favorable repercussion of the reannexation of Lorraine on French foreign trade in metallurgical products. France derived a great benefit from this Association in the assurance that the other members would not challenge her on her own territory, since it was part of the agreement that each participant should have exclusive sales rights on their respective domestic markets. In so far as rails were concerned, France had a clear field before her for developing the home outlet without fear of competition from her powerful neighbors, England and Germany. Moreover, in order to carry out the terms of this international contract it is clear that there must have been an authoritative rail combination within the country.

The post-war period, like the decade immediately preceding 1914, was marked by a host of other international cartels besides the International Steel Agreement and the Erma. For example there was the International Steel Tube Cartel originally founded by Germany and Czechoslovakia and later adhered to by France, Belgium and Poland. Its aim was to fix uniform prices and sales conditions and to allot definite geographical areas as markets to each of its participants. France became a member also of the International Aluminium Cartel which is European in its scope and which endeavors to prevent American interests from stretching too dominating a hand across the Atlantic. Among other outstanding international combinations in which France participated after the war were the Wooden Screw, the Bottle Manufacturers and the Incandescent Mantle Cartels. All of these are proof of considerable coherence, if not of monopoly, within the French industries concerned.

Thus, in the post-war era, monopolistic combinations came to be fairly prevalent in France. They took various guises and forms, but they ceased to be instruments of international economic rivalry. Their purpose, beyond their purely domestic rôle, was rather to meet similar foreign organizations on grounds of peace and amity and cordial understanding. The field of commercial battle was too perilous for all parties concerned in this epoch of constant readjustments, political changes, monetary fluctuations and fundamental technical revolutions in industry. That is why there was so vigorous a revival of international trusts, cartels and ententes of all sorts in Europe. The dangers of cut-throat competition were being averted. Only the laborer and the consumer trembled. Time alone will tell whether their anxiety is well-founded.

International Potash Agreement

If no reference has as yet been made to the International Potash Agreement, it is only because this combination differed from the others in being a public act rather than a private commercial arrangement. The French State was indirectly a party to it. This was not a consequence of any deliberate policy, but simply occured in that curious, devious way which often characterizes the history of important events.

Before the war all the known potash resources of any practical value were situated within German borders. The richest mines were those of Stassfurt, and the only other mines of consequence were found in Alsace just north of Mulhouse. As these latter potash beds were neither as rich nor as easy to exploit as those of Stassfurt, the Germans had neglected them, to concentrate their attention on the more economical enterprise further east.[36] Even those potassic mineral resources of Alsace which belonged to a Franco-Alsatian company, the *Société par Actions des Mines de Kali Sainte-Thérèse*, fell under the ban of partial neglect, because the whole national system of potash extraction was controlled by the all powerful German combination, known as the *Kalisyndikat*. When, however, the war was over, and Alsace-Lorraine was reannexed to France, the Franco-Alsatian potash company, whose mines during the war had been taken over by German authorities, resumed normal activity. The German Alsatian mines, which were by far the most extensive, were sequestered by the French and administered as sequestrated property until April 22, 1924. Then the French State finally bought these sub-soil resources, with the intention not of permanently keeping them, but of disposing of them as the French Parliament should decide.

By its purchase of German potash mines in Alsace, the French State became by the force of circumstances a member of one of the strongest monopolistic combinations of France. As soon as the Alsatian mines had been separated from Germany, it was clear to the French that by acting separately neither the private Kali Sainte-Thérèse Company nor the sequestrated mines could offer any sort of commercial resistance to the German *Kalisyndikat*, which was still in possession of the vast Stassfurt mines. Consequently, all the French mines united immediately after the Armistice to form a common sales office, the *Bureau Provisoire de Ventes des Potasses d'Alsace*, which was later transformed into the *Société Commerciale des Potasses d'Alsace*. This is all in the tradition of the French combination movement — to form a separate company to take charge of sales for all the participants, and then to distribute the orders according to a predetermined agreement.

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[36] De Retz, "La Potasse," in *Chimie et Industrie*, Tome I, pp. 1222–1227.

The formation of an international potash cartel was then only a matter of time. It was inevitable. The French *Société Commerciale des Potasses d'Alsace* and the German *Kalisyndikat* were the only organizations present on the international market for the sale of potash to the rest of the world. Seven years of commercial rivalry led only to continued mutual injury, even to the German *Kalisyndikat* which was many times larger than the corresponding French organization.[37] For example, a distinguished French official wrote in 1924: "A study of the statistics reveals how much the German potash industry has suffered from Alsatian competition. . . . While in France the sales during 1923 represented 113 per cent of the 1922 sales and 275 per cent of the 1919 sales, in Germany the sales during 1923 were only 68 per cent of those of 1922, and 107 per cent of those of 1919. . . . According to the German press reports, the German syndicate considers the potash situation very serious, and is determined to take energetic measures to remedy it." [38]

The "energetic measures" proved to be an amicable understanding with the French. On December 29, 1926, there was signed at Paris the International Potash Agreement.[39] This was

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[37] Production of Potash Salts in France and Germany — (Source: *Annuaire Statistique* and the League of Nations: *International Economic Conference Documentation on the Potash Industry*, Geneva, 1927):

Year	France (In thousands of tons)	Germany (In thousands of tons)
1919	591	7,888
1920	1,222	11,390
1921	884	9,196
1922	1,327	13,079
1923	1,578	11,350
1924	1,665	8,104
1925	1,926	12,044

[38] De Retz, *op. cit.*, p. 1226.

[39] The text was published in *La Journée Industrielle*, January 14, 1927.

a ten-year contract by which the German *Syndikat* and the French *Société* undertook not to invade each other's national territory, and to divide the remaining non-French and non-German markets in agreed proportions. Germany was to fill seven-tenths of all foreign orders and France three-tenths up to combined sales of 840,000 tons per annum. If the total amount of potash sold outside France and Germany should exceed this figure, the remainder was to be divided equally between the participants. Provision was made for the establishment of an adequate administrative organism to carry out the terms of the contract.

One of the most interesting features of the International Potash Agreement is the fact that it was signed by a French Government official, M. de Retz, the director-general of the state-owned potash mines. What then was the post-war attitude of the French State toward industrial combinations? Were there no anti-trust laws in France? Was the French Government devoid of any anti-monopoly policy? One thing is clear: the State not merely connived at the existence of the monopolistic *Société Commerciale des Potasses d'Alsace*, but was actually a party to it.

4. COMBINATION LEGISLATION IN FRANCE

In fact, France had anti-monopoly legislation of very long standing, so old that it antedated the modern industrial trust. Therein lies the tale of its weakness and of the general inconsistency which characterized its later application by the French courts. Articles 419 and 420 of the Penal Code, which embody the main provisions of French law with respect to combinations,[40] were formulated in 1810, and they naturally reflected the conditions of that particular epoch. The object of these laws was to prohibit, under penalty of fine and imprisonment, any maneuvering of the market or any association or coalition which would raise or lower prices of a given commodity beyond the point that the normal interplay of supply and demand would have determined. The legislator of that period wished to put an end to the reprehensible practice of speculative monopolists who took advantage of public calamities by buying up most of the available stock of some indispensable article, like wheat, and then squeezing heavy ransom from the public. These monopolists had been particularly active in the years of deficient crops which led to a severe famine at the close of the *ancien régime*, and again during the political disorders of the French Revolution, and also in the course of the economic crises which resulted from the recurrent Napoleonic wars.

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[40] The following are the French laws bearing more or less directly on combinations: articles 419 and 420 of the Penal Code; article 10 of the law of April 20, 1916, which was virtually abrogated by the law of October 23, 1922; the law of December 3, 1926; articles 6, 1108, 1131, 1133, 1382 of the Civil Code; and article 7 of the law of March 2 and 17, 1791.

There is, in fact, little in common between these sporadic commercial "corners" and modern industrial combinations. Yet from 1810 down to the end of 1926 the letter of the law hung like the sword of Damocles over the heads of every industrial or commercial *comptoir* or cartel formed in France. If they were allowed to live, it was only because of the extraordinary liberality of the courts which interpreted articles 419 and 420 as aiming exclusively at combines guilty of fraudulent practices.[41] A few local "corners," like that of the milk dealers of Château-Thierry in 1915,[42] were dissolved, but the larger industrial combinations managed by some twist in jurisprudential logic to escape, although it would be extremely difficult to contend that they left prices unaffected.

After one hundred and sixteen years a law was finally passed by the French Parliament on December 3, 1926, amending articles 419 and 420 of the Penal Code. There was no attempt, however, to modernize the terms of the articles, or to remove their anachronistic flavor. The changes simply increased their severity. The amendments aimed to punish attempts as well as consummations of the crime; they specified that understandings between traders and industrialists for the purpose of acquiring disproportionate profits were prohibited even if no fraudulent procedure was involved; and they declared it to be no longer necessary, as it had been under the old provisions of article 419, that such understandings should be made between producers and possessors of one and the same class of goods.

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[41] Lapergue, *op. cit.*, pp. 67–93.

[42] Tribunal de Commerce, Château-Thierry, December 3, 1915, D. 16.2.95, cited by Lapergue, *op. cit.*, p. 68.

Nevertheless, it was made very clear, in the parliamentary debates, that the law of December 3, 1926,[43] was not designed to impede the formation or operation of cartels, *comptoirs*, and *ententes*, the object of which was to preserve a normal equilibrium between production and consumption. The hope was expressed that this latter kind of combination might soon be even sanctioned and regulated by law. It is evident from the discussion of the law that what the legislators and the Government intended was simply to throw a sop to the public which was becoming agitated under the constant rise in the cost of living during and after the war. The combination movement remained untouched. In the course of the debates in the Senate, M. Bokanowski defined the attitude of the Government as follows: "M. Poulle [the reporter] referred to a number of understandings which have been made for the purpose of regulating not only the internal but also the international commercial policy of France, and these have been formed, if not at the instance or initiative of the Government, at least under its benevolent supervision. Understandings of this type will have nothing to fear from the law in the future, so long — as M. Poulle stated — as they involve no criminal or punishable offence. . ."[44]

It would, in all probability, have been extremely unwise for the French Government to put any obstacles in the way of a more coherent organization of industry. It is generally admitted that in an economic world composed of immense enterprises, small-scale units are bound to be annihilated. In fact, the post-war industrialization of France has been characterized not only by the physical expansion of industrial plants and business firms, but by their union under a common rational direction. In the face of vast combinations in Germany, the United States and England, the French key industries under scattered control would have had

[43] *Journal Officiel, Doc. Parl., Chambre*, séance du 6 mars 1924, pp. 1116–1134; 2ᵉ séance du 13 mars 1924, pp. 1258–1268; *Sénat*, séance du 19 novembre 1926, pp. 1647–1655; *Lois et Décrets*, le 4 décembre 1926, p. 12722.

[44] *Journal Officiel, Doc. Parl., Sénat*, séance du 19 novembre 1926, p. 1654, cited in the League of Nations, *Review of Legislation on Cartels and Trusts*, drawn up by M. Clemens Lammers, p. 20, footnote.

almost no chance of obtaining a foothold on the international market. Furthermore, strong domestic combinations have proved to be indispensable prerequisites for the conclusion of international agreements purporting to put an end to cut-throat competition disastrous to all parties concerned. Paradoxical as it may seem, the elimination of competition has become a competitive necessity.

APPENDICES

APPENDIX A[a]

QUARTERLY INDEX OF THE COST OF LIVING IN SIX PRINCIPAL CITIES OF FRANCE[b]

(1914 = 100)

CITY		1920				1921				1922				1923			
		1st	2d	3d	4th	1st	2d	3d	4th	1st	2d	3d	4th	1st	2d	3d	4th
Paris		295	341	363	370	338	307	295	297	291	302	289	300	324	334	331	345
Lyons		...	...	316	304	274	250	247	250	249	259	257	264	284	280	290	...
Bordeaux		388				360	303	303	311	315	335	321	325	...	332	349	363
Rouen		333	349	376	372	330	327	309	302	295	299	299	307	312	316	314	334
Dijon		...	335	378	359	329	329	294	314	...	295	...	301	321	348	361	369
Grenoble		...	385	...	439	406	367	351	344	338	341	357	347	356	362	373	413
Combined Index	Quarterly	339	359	364	372	339	314	300	303	297	305	304	307	329	329	336	365
	Annual	358				314				303				340			

CITY		1924				1925				1926				1927	
		1st	2d	3d	4th	1st	2d	3d	4th	1st	2d	3d	4th	1st	2d
Paris		365	366	367	377	386	390	401	421	451	485	539	545	524	...
Lyons		...	325	328	338	353	350	361	379	392	418	482	500	481	...
Bordeaux		377	372	377	387	391	401	413	440	469	561	629	607	609	...
Rouen		350	354	353	367	380	380	390	406	427	454	502	575	553	...
Dijon		394	390	398	412	417	426	440	455	485	530	600	630	608	625
Grenoble		423	433	447	424	431	438	450	449	484	507	582	609	585	...
Combined Index	Quarterly	382	373	378	384	393	397	409	425	451	492	566	578	560	...
	Annual	379				406				522					

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[a] See Chap. IV, p. 79.

[b] Source: *Bulletin de la Statistique Générale de la France.*

APPENDIX B[1]

INDEX NUMBERS OF INDUSTRIAL AND MINERAL PRODUCTION IN FRANCE

Tables of index numbers of industrial and mineral production in France were compiled by M. Jean Dessirier, statistician at the *Statistique Générale de la France.* He first published articles in the October 1924 and the April 1926 issues of the *Bulletin de la Statistique Générale de la France*,[2] describing his method in detail, and giving complete series of index numbers. Beginning with the July 1926 number of the *Bulletin*, the composite general index and the combined group indices were published regularly under the rubric "*Mouvement économique général*," so that it is possible to extend these series to any given date. From time to time the *Bulletin* publishes tables of the component index numbers also brought up to date.

M. Dessirier computed separate series of indices of physical production for 18 different industries (17 for the years 1922, 1923 and 1924).[3] The five extractive industries were then grouped and a weighted arithmetic average was computed giving a combined extractive industries group index. The same was done with the three textile industries, the two (three up to 1921) metallurgical industries, and the four (three up to 1925) metal trades industries. Besides these there were the building trades, leather, rubber and paper industries which remained separate series. Then a weighted arithmetic average was made of the combined group index numbers and the four ungrouped index numbers to obtain the composite production index.

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[1] See Chap. V, p. 97.

[2] Jean Dessirier, "Essai de Détermination d'Indices mensuels de la Production industrielle en France," October 1924, pp. 73–109; and "Indices mensuels de la Production industrielle en France — Comparaison avec d'autres Indices économiques," April 1926, pp. 297–332.

[3] Up to 1921 the annual indices included in the metallurgy group metals other than ferriferous. This category was dropped after that year, but in 1925 an automobile index was compiled as a separate series and introduced into the metal trades group.

The data from which these index numbers were compiled all relate exclusively to physical quantities of goods, and never to value. Actual production figures were used in the computation of the indices of the extractive industries group, of cotton and wool industries (after the war), and of the metallurgy group only. For the remaining series, that is to say, for the greater part, other physical quantity criteria were used. The post-war silk production index, for example, was based on a moving average of the weight of silk passing through the conditioning house at Lyons during the month considered and the two preceding months. The iron and steel products index is in reality an index of the apparent consumption of steel (domestic production plus imports minus exports reduced to a four-month moving average of the given month and the three preceding months). The index of production in the automobile industry was computed from the number of automobile permits issued for new cars in the département of the Seine. The copper products index was also computed on the basis of domestic production plus net imports of copper in the month considered, averaged with the net imports of the five preceding months.[4] The annual index number for shipbuilding is based on the average of the tonnage launched in the year considered and the following year, while the quarterly index numbers were computed from the tonnage in the process of construction of the quarter considered averaged with the preceding quarter and corrected proportionally each year to correspond with the annual launching figure. Production in the building trades was measured according to the number of floors indicated in the building permits of some cities (Paris, Lyons, Marseilles, Strasbourg, Grenoble, Rouen, Rennes), and in the case of other cities (Dijon, Toulon, Troyes, Tours, Cherbourg, Le Havre, Nice, Montpellier, Pau, Orléans, Nantes, Saint Dié), where information as to the number of floors was lacking, according to the number of building permits weighted by the number of floors in the preceding group. The building trades index used is a moving average of the month considered and the five preceding months; and from 1925 on the monthly indices were corrected for seasonal variations. The leather industry index was calculated from net imports and domestic production (derived from abattoir figures) of hides — the data of each month being averaged with those of the six preceding months. The indices of both paper and rubber production were based on moving averages[5] of the monthly net imports of the raw materials used (chemical and mechanical wood pulp for paper, and raw rubber and gutta-percha for rubber).

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[4] As only annual data exist for the domestic production of copper, the monthly indices are first constructed on the basis of net imports, and then corrected proportionally at the end of each year to account for domestic production.

Both the combined group indices and the composite production index are, as it has been noted above, weighted arithmetic averages. The weights applied to the pre-war annual index numbers were simply the percentage ratios of the number of persons gainfully employed in each industry to the total gainfully employed population, according to the 1906 Census. These weights were modified for the computation of the base year and post-war combined and composite index numbers, in order to take into account the inclusion of Alsace-Lorraine and the relative fluctuations in production in different industries from 1906 to 1913. Changes in the weights were determined sometimes by the actual contribution of Alsace-Lorraine to production, sometimes by the ratio of the number of gainfully employed in the reannexed provinces to that of the rest of France within a given industry, sometimes by the increase in output from 1906 to 1913 as revealed by the indices for these two years, and sometimes by a combination of the last method with either of the two preceding ones.[6]

All the post-war index numbers represent the physical production of greater France, including Alsace-Lorraine. In order to make pre-war and post-war comparisons more valid, the production data of Alsace-Lorraine were included in computing the base for the post-war indices. Moreover, the rebuilding and reconstruction activity in the devastated regions of the north was left entirely out of account, as can be seen from the absence of any city of this area from the list of those whose building permits were used for the building trades index. Nevertheless, as M. Dessirier himself points out, while the composite index-number series probably shows more or less approximately the general trend of production in France, the difference in level between the index numbers of any two years is of limited significance. All of the industries considered represent only about half of the total production of France. Such important industries as the clothing trades, employing 22 per cent of the total gainfully employed population in 1906, the wood-working industries (10 per cent), the foodstuffs industries (7 per cent), the chemical, printing and glass industries (each 2 per cent) were not included.

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[5] A six-months moving average of the month considered and five preceding months for paper, and a twelve-months moving average of the month considered and eleven preceding months for rubber.

[6] The textile industries weight was raised on the basis of the contribution of Alsace-Lorraine to the cotton and wool industrial equipment — about 30 per cent having been added to cotton spindles and looms and 23 per cent to wool spindles and looms.

CONSUMPTION OF IRON

(In thousands of metric tons

YEAR	1 Production of Cast Iron	2 Production of Pig Iron	3 Percentage of Pig Iron Production used as Cast Iron 1 ÷ 2	4 Total Pig Iron Consumed in France	5 Estimated Consumption of Pig Iron as Cast Iron 3 × 4	6 Production of Cast Steel	7 Production of Weld Iron and Steel [c]
1893	481	2,003	24.0	2,000	480	800	821
1894	470	2,069	22.7	2,000	454	830	803
1895	473	2,003	23.6	1,900	448	890	771
1896	501	2,339	21.4	2,200	471	1,190	841
1897	522	2,484	21.0	2,400	504	1,340	796
1898	507	2,525	20.1	2,400	482	1,450	780
1899	512	2,578	19.9	2,500	498	1,520	849
1900	548	2,714	20.2	2,700	545	1,590	722
1901	577	2,389	24.2	2,400	581	1,440	576
1902	420	2,405	17.5	2,300	403	1,590	650
1903	553	2,841	19.5	2,700	525	1,860	600
1904	607	2,974	20.4	2,800	571	2,100	662
1905	636	3,077	20.7	2,900	600	2,255	670
1906	583	3,314	17.6	3,200	563	2,452	748
1907	640	3,590	17.8	3,400	605	2,767	580
1908	704	3,401	20.7	3,300	683	2,723	560
1909	712	3,574	19.9	3,500	697	3,039	558
1910	730	4,038	18.1	4,000	724	3,413	526
1911	824	4,470	18.4	4,411	812	3,837	518
1912	884	4,939	17.9	4,778	855	4,429	525
1913	954	5,207	18.3	5,145	942	4,687	371
1919	606	2,447	24.8	2,427	602	2,156	102
1920	784	3,344	23.4	3,169	742	2,706	144
1921	836	3,447	24.3	2,815	403	3,099	117
1922	1,504	5,277	28.5	4,609	1,314	4,535	150
1923	1,123	5,432	20.7	4,888	1,012	5,110	210
1924	1,473	7,693	19.1	6,966	1,331	6,901	165
1925	1,624	8,495	19.1	7,834	1,496	7,446	201
1926	1,749	9,396	18.6	8,739	1,625	8,430	193

[a] See Chap. VIII, p. 191.

[b] Ministère des Travaux Publics, *Statistique de l'Industrie minérale* and the *Annuaire Statistique.*

[c] The figures found under the rubric "fer et acier soudés" since 1904 were extended

DIX C[a]

And Steel in France[b]

unless otherwise indicated)

Year	8 Total Domestic Production of Iron and Steel 5 + 6 + 7	9 Net Exports of Iron and Steel Manufactured Objects[d]	10 Net Exports of Iron and Steel, Raw and Semi-manufactured	11 Total Exports of Scrap	12 Total Iron and Steel Exports 9 + 10 + 11	13 Net French Consumption 8 − 12	14 Per Capita Consumption of Iron and Steel (In kilograms)
1893	2,101	79	− 4	8	83	2,018	52.57
1894	2,087	125	12	7	144	1,943	50.57
1895	2,109	186	35	11	232	1,877	48.80
1896	2,502	417	33	21	471	2,031	52.72
1897	2,640	364	52	22	438	2,202	57.04
1898	2,712	240	34	28	302	2,410	62.11
1899	2,867	2	31	47	80	2,787	71.64
1900	2,857	− 647	− 27	28	− 646	3,503	90.05
1901	2,597	28	38	30	96	2,501	64.16
1902	2,643	425	53	56	534	2,109	54.00
1903	2,985	57	59	45	162	2,823	72.15
1904	3,333	370	91	36	497	2,836	72.36
1905	3,525	882	75	42	999	2,526	64.40
1906	3,763	484	68	75	627	3,136	79.86
1907	3,952	− 258	79	13	− 166	4,118	104.86
1908	3,966	− 318	72	11	− 235	4,201	106.71
1909	4,294	− 370	75	12	− 283	4,577	116.07
1910	4,663	− 314	21	12	− 281	4,944	125.03
1911	5,157	− 75	198	113	236	4,921	124.2
1912	5,809	− 61	131	191	261	5,548	139.7
1913	6,000	− 126	337	226	437	5,563	139.8
1919	2,860	− 777	− 1,037	131	− 1,683	4,543	117.39
1920	3,592	− 873	− 375	427	− 821	4,413	112.57
1921	3,619	− 396	431	580	615	3,004	76.55
1922	5,999	− 193	432	977	1,216	4,783	121.51
1923	6,332	314	746	507	1,567	4,765	120.26
1924	8,397	269	1,211	449	1,927	6,470	160.50
1925	9,143	618	2,684	525	3,827	5,316	130.90
1926	10,248	840	2,704	222	3,766	6,482	158.91

back to 1893 by taking the production of "fers" alone plus the production of "aciers puddlés," "aciers affinés" and "aciers réchauffés."

[d] Designated in French foreign trade statistics as "produits des industries mécaniques." "Embarcations" and "aeronefs" were included only after 1911.

FOODSTUFFS: FOREIGN TRADE

YEAR	Per Capita Imports of Foodstuffs[b] (In metric tons)	Production of All Cereals[c] (In thousands of tons)	Net Imports of All Cereals[b] (In thousands of tons)	Ratio of Net Imports of All Cereals to Production	Production of Wheat[c] (In thousands of tons)	Net Imports of Wheat[b] (In thousands of tons)
1890	....	....	....	....	....	....
1891	....	167,226[d]	20,266[d]	12.1%[d]	77,603[d]	16,899[d]
1892	....	155,756	19,653	12.6	72,889	16,593
1893	....	164,736	20,192	12.3	84,609	13,874
1894	....	169,754	16,943	10.0	87,228	9,052
1895	....	181,958	13,609	7.5	92,900	6,274
1896	....	167,618	10,411	6.2	83,651	3,876
1897	.084	169,369	17,025	10.1	85,947	8,776
1898	.134	171,361	17,232	10.1	88,231	8,659
1899	.076	180,574	15,130	8.4	95,789	7,320
1900	.062	170,753	8,583	5.02	90,891	1,380
1901	.064	165,812	8,387	5.1	87,485	1,833
1902	.064	172,747	9,337	5.4	90,880	3,060
1903	.074	172,126	7,897	4.6	89,857	3,206
1904	.064	172,765	7,992	4.6	90,487	2,851
1905	.065	163,965	8,744	5.3	87,378	2,138
1906	.080	175,674	10,477	6.0	94,779	2,578
1907	.080	174,577	9,115	5.2	93,134	2,165
1908	.066	177,901	7,350	4.1	95,899	1,480
1909	.071	171,000	8,806	5.1	84,261	2,388
1910	.106	170,844	19,022	11.1	84,774	9,426
1911	.163	166,434	22,396	13.5	82,521	11,489
1912	.117	174,201	27,650	15.9	88,545	14,578
1913	.139	....	....	....	....	....
1914	.131	....	....	....	....	....
1915	.162	....	....	....	....	....
1916	.208	....	....	....	....	....
1917	.179	....	....	....	....	....
1918	.133	....	....	....	....	....
1919	.180	....	....	....	....	....
1920	.158	125,320	27,655	22.0	67,389	19,347
1921	.109	139,290	21,864	15.7	72,911	13,622
1922	.129	145,291	17,239	11.9	76,417	10,179
1923	.143	145,885	19,218	13.1	72,581	11,283
1924	.141	157,294	20,366	12.9	80,476	13,218
1925	.127	158,280	16,904	10.7	78,029	9,523
1926	.124	....	....	....	....	....

[a] See Chap. VIII, p. 206.

[b] *Statistique Mensuel du Commerce Extérieur de la France.*

[c] *Statistique Agricole Annuelle;* from 1924 on, *Bulletin de la Statistique Générale de la France.*

DIX D [a]

AND PRODUCTION IN FRANCE

YEAR	Ratio of Net Imports of Wheat to Production	Production of Potatoes [c] (In thousands of tons)	Net Imports of Potatoes [b] (In thousands of tons)	Ratio of Net Imports of Potatoes to Production	Ratio of Value of Foreign Trade in Foodstuffs to Value of Total Foreign Trade [e]
1890	....	....	....	....	29.1%
1891	21.8% [d]	119,140 [d]	1,550 [d]	1.3 % [d]	29.3
1892	22.8	121,812	1,535	1.26	28.3
1893	16.4	127,322	1,221	0.96	25.0
1894	10.4	125,287	1,063	0.85	26.9
1895	6.75	128,966	1,067	0.83	22.9
1896	4.6	123,958	1,038	0.84	23.0
1897	10.2	120,316	905	0.75	23.2
1898	9.8	118,323	982	0.83	27.2
1899	7.6	121,445	1,146	0.94	18.75
1900	1.5	122,060	1,538	1.26	18.0
1901	2.1	118,191	1,429	1.21	18.2
1902	3.4	116,029	1,490	1.28	17.8
1903	3.6	116,891	1,932	1.65	18.0
1904	3.2	127,126	2,030	1.6	16.0
1905	2.5	122,196	1,791	1.47	16.6
1906	2.7	127,747	1,456	1.14	15.2
1907	2.3	136,923	1,562	1.14	15.1
1908	1.5	158,783	2,055	1.3	15.7
1909	2.8	140,727	1,551	1.1	14.9
1910	11.1	379,828	418	0.1	20.7
1911	13.9	121,077	173	0.14	19.5
1912	16.5	137,952	344	0.25	17.7
1913	....	....	....	....	17.3
1914	......	....	....	....	....
1915	....	....	....	....	....
1916	....	....	....	....	....
1917	....	....	....	....	....
1918	....	....	....	....	....
1919	....	....	......	....	25.0
1920	28.8	92,259	209	0.23	18.9
1921	18.7	108,644	36	0.03	20.2
1922	13.3	102,914	772	0.74	16.8
1923	15.6	126,384	525	0.42	16.8
1924	16.4	133,279	682	0.51	15.9
1925	12.2	134,847	485	0.36	14.0
1926	....	....	......	....	14.0

[d] Three-year moving averages.

[e] *Annuaire Statistique.*

APPENDIX E[a]

I. FOREIGN TRADE IN COTTON FABRICS (LOOM-PRODUCTS ONLY)[b]

(In tons)

YEAR	EXPORTS	IMPORTS	NET EXPORTS
1913 (without Alsace-Lorraine)	48,709	3,275	45,434
1921 (including Alsace-Lorraine)	54,971	2,942	52,029
1922 “ “ “	40,875	2,950	37,925
1923 “ “ “	41,028	2,529	38,499
1924 “ “ “	62,283	2,537	59,746
1925 “ “ “	50,537	2,894	47,643
1926 “ “ “	55,176	2,561	52,615

[a] See Chap. XIII, p. 365.

[b] Source: *Stat. mens. com. ext.* The items included were suggested by the Syndicat général de l'Industrie cotonnière française. They are designated in the French foreign trade reports under the following headings: "(1) écrus, (2) blanchis ou fabriqués avec des fils blanchis, (3) teints, (4) fabriqués avec des fils teints, (5) imprimés, (6) percaline enduite pour reliure et cartonnage, etc., (7) velours, (8) brillantés et façonnées, (9) piqués, (10) basins, (11) couvertures, (12) plumetis et gazes façonnées, (13) mousselines, brodées ou brochées pour ameublement et vêtements, (14) toiles cirées, (15) étoffes mélangées."

II. TOTAL COTTON GOODS EXPORTS[a]

YEAR	VALUE IN THOUSANDS OF FRANCS			WEIGHT IN TONS		
	Cotton Goods	Cotton Fabric	Cotton Articles	Cotton Goods	Cotton Fabric	Cotton Articles
1913 (without Alsace-Lorraine)	385,457	190,482	194,975	55,355	41,308	14,048
1921 (including Alsace-Lorraine)	1,459,302	973,942	485,360	58,655	49,030	9,625
1922 “ “	1,255,539	859,312	396,227	43,707	35,242	8,465
1923 “ “	1,445,620	1,083,055	362,565	44,453	33,049	11,404
1924 “ “	2,553,816	2,192,003	341,813	67,132	53,732	13,399
1925 “ “	2,515,444	1,673,321	842,123	55,407	41,243	14,164

[a] See note to Table III, p. 595.

III. EXPORTS OF COTTON FABRICS [a]

Year	To Foreign Countries	To the Colonies
1913	15,292 tons	26,016 tons
1921	38,240 “	10,790 “
1922	20,637 “	14,605 “
1923	15,100 “	17,949 “
1924	34,214 “	19,519 “
1925	16,524 “	24,719 “

[a] For the more detailed analysis of cotton goods exports, it was only possible to classify the five main categories of loom products as cotton fabrics. They are (1) tissus de coton écru, (2) tissus de coton blanchi, (3) tissus de coton teint, (4) tissus fabriqués avec des fils teints, (5) tissus imprimés.” The remaining categories are considered as cotton articles. This explains the difference between the above figures and the cotton fabric export figures in Table I above.

IV. IMPORTS OF COTTON GOODS INTO THE PRINCIPAL FRENCH COLONIES [a]

From	to Morocco	to Tunis	to Senegal	to Indo-China
		1913		
France	4,628	10,674	4,723	77,383
England	43,937	15,645	27,102	1,543
Italy	......	8,441	......	.....
Holland	......	......	41,568	.....
Belgium	......	1,964	5,178	.....
		1925		
France	8,310	26,784	15,377	70,482
England	51,480	1,590	17,215	1,225
Italy	8,006	2,612	2,020	.....
Belgium	2,057	......	......	.....

[a] Only the principal countries of origin were noted. The article known as “guinées,” being given in meters, was not included.

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